CHICAGO NATURAL HISTORY MUSEUM
Bulletin
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MEMBERS' CHILDREN EXPLORE THE WORLD

MIRIAM WOOD, CHIEF
RAYMOND FOUNDATION

THE NEWEST, and one of the most rewarding activities developed by the Museum in recent years for its members, has been the Members' Children Workshops offered on Saturdays during the fall. Presented in 1963 and 1964, these workshops have attracted more than 600 children in these two years.

The programs were developed and given by staff members of the Raymond Foundation, which is one of the educational divisions of the Museum. Their purpose was to introduce our young members to the story of the natural world and man. The subjects of the workshops ranged from cave men and Indians to spices, fall fruits and colors, rocks and minerals, fossils, insects, and animals without backbones. The learning experience was structured to give the children an opportunity to meet our scientific staff, to work closely with Museum specimens and artifacts, and to seek answers to some of their questions about the world around them.

In the first year, the programs were offered to youngsters from 10 to 13 years old, but younger ones, from 6 to 9, were included this year. Parents who brought their children had an opportunity to see progress being made in the Museum —major construction under way, research, and the preparation of new exhibits. It was a pleasure to talk with these parents in small groups while they waited for their children. But this was just a side benefit for us; all the emphasis in the programs was on the children.

They came with enthusiasm—some shyly, some exuberantly, some bringing their own collections and books, but all with alertness and a zest for exploring everything in nature. Their enthusiasm was contagious and the Museum staff loved them.

When the workshops were over, we asked the young people to give us their reactions so that we might incorporate them in our planning for future sessions. One 10-year-old boy wrote: "I think you learn a lot . . . by just plain talking about facts and bringing out more facts." He seemed to be expressing the views of so many who eagerly talked, looked, examined, felt, sniffed, made tests, watched movies, and asked questions and more questions.

The youngest ones worked with rocks in one workshop, and with insects in another. They seemed to get the most from handling; one 8-year-old put it: "There were insects to touch . . . and I liked dissecting a grasshopper."

The fossil workshop prompted a 10-year-old boy to write "Fossils . . . it's my hobby; it's one job machines can't take over."

More girls than boys participated in the spices program, where they sniffed aromatic herbs with delight, but at least one boy discovered that "spices were interesting because I hadn't tasted or given thought(s) to them before."

After the experiments on rocks and minerals, this comment came: "I found out you can't tell rocks from the outside."

The final line in the evaluation of a boy who signed his name and gave his age as 12 years, 8 months, was: "I wish you had one [workshop] on your plant exhibit. It is fantastic." And it is "fantastic," as is the whole world of nature and man, which offers us all so much to see, understand, and enjoy. We look forward with pleasure to more programs for our young members. ■

OF NATURE

In the workshops, youngsters discover spices, fossils, rocks, insects, and the animals hunted by prehistoric men

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

APPOINT NEW ANTHROPOLOGY CHIEF CURATOR

DR. DONALD COLLIER has been appointed Chief Curator of the Department of Anthropology at Chicago Natural History Museum as of December 1, 1964.

A member of the Museum's staff since 1941, Dr. Collier is a specialist in the Indians of South America and the Aztec and Inca civilizations of Mexico and Peru.

As head of the Museum's Department of Anthropology, Dr. Collier replaces Dr. Paul S. Martin, who is retiring after 30 years as Chief Curator.

Dr. Martin is president of the Society for American Archaeology, and expects to continue an active program of teaching and research as Chief Curator Emeritus at the Museum.

Donald Collier was born on May 1, 1911, in Sparkill, New York. He did his undergraduate work at Stanford University and the University of California at Berkeley, and received his Doctor of Philosophy degree in anthropology from the University of Chicago.

After teaching at Washington State College, he came to Chicago Natural History Museum in 1941 as Assistant Curator of South American Archaeology and Ethnology. In 1943 he became Curator, retaining this position until his present appointment.

Dr. Collier's research interests are in the culture history of the New World, especially the rise of the ancient civilizations of Mexico and Peru. He has made three expeditions to South America and several study trips to Mexico for the Museum.

In 1941–42, he directed a pioneer study of an archaeologically unknown area, the southern highland of Ecuador.

In 1946 he excavated in the Viru Valley of Peru, and in 1946 he did archaeological surveying and digging in the Casma Valley of Peru. His work in these coastal sites resulted in new knowledge of the beginnings of intensive farming and of pre-Inca village life between 2000 and 500 B.C., and the development of urbanization and the mass production of handicrafts that took place among the Incas between A.D. 1000 and 1500.

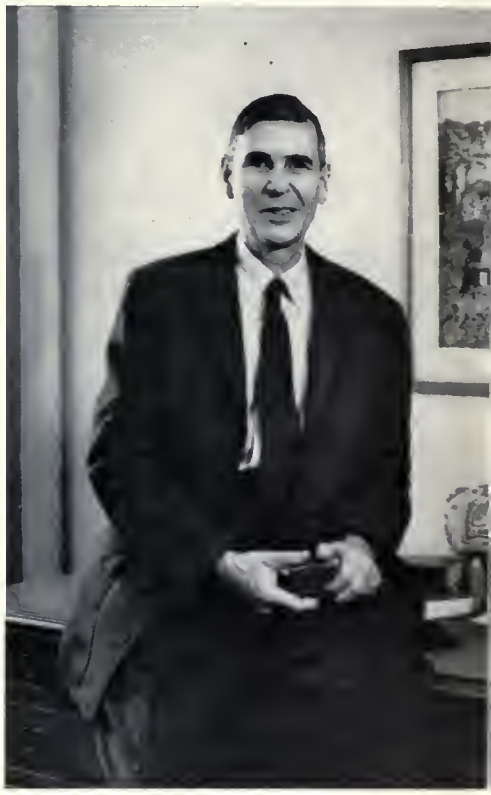
In Mexico, he has studied Aztec and pre-Aztec art, the ancient system of markets, and the relation of irrigation agriculture to the rise of cities.

As the son of John Collier, who for many years worked for the welfare of Indians in the United States and served as Commissioner of Indian Affairs from 1933 to 1945, Collier has also been interested in the Indians of North America. He has studied several Indian tribes in Oklahoma, Montana, and South Dakota. In addition, he has done archaeological work in Arizona, and directed one of the early archaeological salvage projects in the flood area behind Washington's Grand Coulee Dam.

Collier's investigations into the pre-Columbian civilizations of Mexico and Central America have provided original material and authentication for the Museum's exhibition hall on the Aztec and Maya Indians. The hall was completed under his direction in 1960.

At present, Collier has begun to plan a complete revision and reinstallation of the Museum's exhibitions on the Indians of South America.

Collier is a past president of the Central States Anthropological Society and a member of the executive board of the American Anthropological Association. He is a Lecturer in Anthropology at the University of Chicago. He also holds memberships in the Society for American Archaeology, the Institute of Andean Research, Sigma Xi, and—reflecting his interest in art—the Renaissance Society of Chicago.



Dr. Donald Collier

Among his publications are a study of peyote—the plant, the cult, and the drug; an exposition of radiocarbon dating; culture studies of several American Indian tribes; extensive reports of his archaeological work in Ecuador and Peru; studies of Aztec and Maya art; a general book on North American prehistory, *Indians before Columbus*, written in collaboration with Paul S. Martin and George Quimby (recently selected for the White House library); a book on *Indian Art of the Americas;* and numerous reviews.

Collier is married to the former Malcolm Carr, also an anthropologist. They have two college-age sons.

22 - Pound Pyrite Crystal Donated

RECENTLY a fine specimen of pyrite (fool's gold) was donated to the Museum. Although pyrite is a fairly common mineral the particular interest of our specimen is its unusual size and the fact that it is essentially a single crystal with several well-developed cube faces. The faces are nearly six inches on a side and the specimen weighs nearly 22 pounds. As such, it is by far the largest we have in our collection, and in fact it must be as large as or larger than any nugget of fool's gold on record from the entire United States.

It is worthwhile to record the story behind this donation. Mrs. Louise Helton of Copperhill and Mrs. Etoise Pate of Ducktown, Tennessee, visited the Museum sometime ago. They carried back to Tennessee such a favorable impression of their visit that they remembered the Museum when an opportunity arose to show their appreciation in a practical way. The pyrite had been found in the Cherokee Mine of the Tennessee Copper Company at Ducktown, Tennessee. Mr. Oliver Hawk of the Tennessee Copper Company made the specimen available and Mrs. Helton and Mrs. Pate brought it to the Museum.

Dr. Bertram G. Woodland hefts 22-pound pyrite crystal

Presentation was made in memory of Mr. Lynn Pate (Mrs. Pate's late husband) and Mr. Paschal Hughes, who were killed in a mine accident in the Ducktown area in 1963.

Before making the trip to Chicago, Mrs. Helton wrote to Mayor Richard J. Daley, who made the arrangements for the presentation. In a letter to Mrs. Helton, Mayor Daley wrote:

"I am taking the opportunity to thank you for the gift of pure pyrite crystal presented to our Museum of Natural History. Mr. E. Leland Webber, Director of the Museum, informs me that this crystal is a valuable addition to their collection.

"The city of Chicago is grateful for this fine specimen and is especially appreciative of the kindness expressed in making us the recipient of this valuable museum piece."

The Ducktown area, also known as the Copper Basin, is a world-famous metalliferous mining region, copper ore having been mined there since 1847. Since 1907 the sulfur present in the ores has been used in the manufacture of sulfuric acid, which is now one of the region's major products. The ore currently mined, about 1,300,000 tons a year, contains one per cent both of copper and zinc, twenty-six per cent sulfur and thirty-six per cent iron. Our specimen of pyrite (iron sulfide) contains some pyrrhotite (another variety of iron sulfide) and chalcopyrite (copper iron sulfide). The zinc ore is reclaimed and sold to zinc smelters, while the iron, in the form of iron oxide, is sintered and sold as a high-grade iron ore.

MUSEUM GIVEN $200,000 GRANT

THE MUSEUM has received a grant of $200,000 from the Robert R. McCormick Charitable Trust for general support of the Museum's programs of research and education. The gift is the largest private foundation grant received in the history of the Museum.

In accepting the grant, Museum President James L. Palmer said:

"Chicago Natural History Museum is one of the Chicago institutions that serves all ages, from young children to senior citizens, and all levels of education, from the primary grades to the doctoral and post-doctoral level. Opportunities continually arise for enlarging and strengthening our contributions to knowledge and to the community. The generous support of the McCormick Trust is very gratifying as we seek to broaden the base of public support for the Museum.

HOLIDAY SCIENCE LECTURES

ONE OF THE most difficult, yet most important scientific frontiers of our time—the human mind—was probed by Dr. Francis O. Schmitt, Professor in the Department of Biology at Massachusetts Institute of Technology, during the 1964 Holiday Science Lectures held at the Museum on December 28 and 29.

More than 800 outstanding high school students from the Chicago metropolitan area were selected by their school principals to attend the lectures during Christmas vacation.

Dr. Schmitt began his discussion

(*Continued on page 8*)

OUR SUDDEN SPATE OF NEW

A Progress Report

Boxes — crates — cartons — drawers. Truckload after truckload of them, all filled with fossil invertebrates, have arrived at Chicago Natural History Museum from the Walker Museum of the University of Chicago. While the new quarters are being finished, Geology Department staff and assistants are unpacking, sorting, labeling, and putting the University specimens in standard Museum boxes and drawers.

A year ago, our entire collection of fossil invertebrates occupied (to overflowing) 1,672 drawers. The combined collections will be distributed (with space to grow) among 10,625. Stacked one on another, these drawers would tower slightly more than half a mile in the air.

This enlarged collection will shortly take its place as one of the nation's top-ranking "libraries" of fossil invertebrate specimens. For a library it is, not only in the sense that "There are sermons in stones, lessons in the running brooks," but in the use to which it will be put. Members of the Museum staff use the specimens daily as reference material in their research—but if this were their only use we might well be regarded as overindulged. University students use the collections both for learning to recognize and understand fossils and for guiding their first fledgling flights into research. Paleontologists from other institutions in this country and abroad consult this "library" to examine specimens in their special fields. And, true to the uses of libraries, we lend specimens to qualified researchers for their study elsewhere. This practice confers a double benefit: on the scholar who gets the use of the material and on the Museum, whose specimens are thus checked in the light of the latest understanding. All of these values and services will now be enhanced in proportion to the increased size of the collection.

As we unpack the specimens, we find one area after another in which our horizon is broadened. To our fine collection of Mississippian crinoids from Crawfordsville, Indiana, is added a tier of drawers of not only more crinoids, but the rarer associated fossils that will reveal more of that ancient environment. The large Tucker collection of Tertiary marine fossils adds many new localities and faunas to what we had. James Hall's overwhelming quantities of corals, clams, brachiopods, and other denizens of New York's Devonian seas clarify—as even his renowned lithograph plates and lucid discussions could not—the nature of these classic faunas. Each box we open reveals gaps filled and new research material available.

The unpacking has kept up a bustle of activity throughout this past year, first in a basement room, later in the blocked-off half of a major exhibition hall—the only space we could locate that was adequate for the growing stacks of drawers. With space to put the specimens in standard-sized cardboard trays that fit without crowding into their new drawers, and with labels neatly transcribed, we discover with delight fossils from areas long since collected bare, and among them the prime specimens that fell to the lot of the first collectors.

Transcribing the old labels brings us into almost personal contact with legendary figures of seventy or a hundred years ago, men whose names we have long known from their writings, as well as others who simply collected.

One of the large individual collections was brought together by Charles L. Faber, known for a handful of publications from Cincinnati in the '80's and '90's. Many of the labels, on a stiff rag stock, bear the heading "Q.C.N.H. Society" in an antique typeface. For some days we were puzzled by this abreviation, until it occurred to us that Cincinnati is sometimes called the "Queen City of the Ohio," and that there must have been an early Natural History Society using that name. Some day we may find answers to other questions:—did Faber acquire the collection upon the demise of the Society? Was the whole Society just his own name for his own collection? There is no mention of a predecessor in the first number of the Journal of the Cincinnati Society of Natural History. Most of the specimens with these labels are from Germany, probably a reflection of Cincinnati's German heritage (or of Faber's?). On a few labels, the locality is noted as "Württemberg, Germany," on others

Eugene S. Richardson, Jr.
Curator, Fossil Invertebrates

OLD FOSSILS

on the Walker Collection

Like a vast array of safe-deposit boxes, these drawers containing fossil invertebrates from the University of Chicago await their move into new permanent quarters now being constructed as an addition to the Museum building. With Assistant David Techter taking notes, Dr. Richardson puts numbers on the labels to guide the movers in placing the drawers in proper position in their new cabinets.

as "Western Germany." But most are "WGer," which could be either. We decided that this more probably meant Western Germany, rather than Württemberg, and have so transcribed the labels. The labels of the Q.C.N.H. Society included catalog numbers, but there were no corresponding numbers on the specimens, a sad omission when label and specimen have drifted apart. Curiously, the numbers run only from 1 to 119, so that in this collection of many hundreds of specimens each number is used several times. Perhaps the numbers refer to pages of a catalog yet to be found, rather than to individual entries. When Faber collected specimens himself, he jotted down a minimum amount of information on a scrap of newspaper wrapped with each lot. The habit of abbreviating also turns up on these. We found the notations "BM" on some scraps, "KCM" on others. At last, clues from more voluble labels led us to interpret these as "Booneville, Missouri" and "Kansas City, Missouri"—but still, there is always a shade of uncertainty in such interpretations.

Among the fossils of the Haines Collection, another part of the Walker Museum trove, some are cryptically labeled "PCIll." Being by this time aware of what can be done with abbreviations, we shortly concluded that this probably meant "Peoria County, Illinois." In making this and other such interpretations, we depend, of course, on our general familiarity with fossils. The specimens are such as might well have come from Peoria County, but not from Perry, Piatt, Pike, Pope, Pulaski, or Putnam counties. The hundred-year old Haines Collection is interesting in many ways, and we are gradually forming an impression of its gatherer. Apparently she was Mary P. Haines, wife of Joshua Haines of Richmond, Indiana, and a woman of unusual attainments. Her specimens are neatly numbered, each one with a small white paper rectangle pasted to the fossil and bearing a delicately inked number to correspond with a tidy catalog entry. Her interests were broad, as was her correspondence. While her collection is predictably rich in Ordovician fossils from the vicinity of Richmond, there are also many others, including a number of Cretaceous specimens from Texas, probably sent by a friend. Among some papers—including her daughter's German lessons— was an alphabetical list of the plants that she had seen growing in Richmond (including, she notes, garden plants), and a letter from a lady in California enclosing a fern, still sound enough to be placed in the Museum's herbarium.

The most extensive collection, and the most important component of the Walker accumulation, is the vast collection of James Hall (1811–1898). This was bought by the University of Chicago from Hall's estate. But though thousands of specimens were unpacked and have now served in the instruction of generations of students, there was not room in the Walker Museum for all of it. Over three hundred wooden boxes remained to be unpacked at the time of the transfer to Chicago Natural History

A corner of Exhibit Hall 36 has been blocked off to serve as a workroom for transferring University specimens to Museum storage drawers. The drawers seen above contain about a quarter of the expanding collection of fossil invertebrates that will eventually be housed in the building addition now under construction.

Museum. It is the unpacking of these specimens that has been the most rewarding. Here are the fossils studied by America's greatest invertebrate paleontologist at the time when he was writing his renowned series of quarto volumes published "by authority of the State of New York." Here are proof sheets of the lithographed plates, with Hall's notations to the artists. Here also is a fine though inadvertent collection of Americana in the form of old newspapers, cigar boxes, pill boxes, used to wrap or contain the specimens. The greatest number of newspapers date from the 1870's and '80's, issuing from New York, Albany, Cincinnati, and many smaller towns. The oldest, from Waterville, New York, were printed in 1830 and served as packing for a quantity of plaster and sulfur molds of fossil crinoids. As it is possible that these molds may represent important lost specimens, they are being kept with all care in our new trays and drawers.

Though a librarian may aspire to obtain copies of every book in a limited field, either in the original or in microfilm, our library of fossils can never be complete. Many species of extinct invertebrates are known from single fragmentary specimens; others, whose type material is now lost, are known from old, inadequate publications. Our goal, rather, is to have a good general representation of the field of fossil invertebrates, and toward this goal each collection brought to the Museum advances us.

Tiffany, Tucker, Sampson, Sloss, Smith, Weller, James, Jenni, Krantz, Bassler, Moore, Plummer—the roll of collections goes on. Some are small, some large, some important, others less so, but all were brought together carefully and even lovingly, and each lends its character to the whole that is opening before us. They will now be blended with the collections already here—Roy, Head, Langford, Ward, Dyer, Nelson and others—each specimen put with others of its kind in a self-indexing arrangement. Thus both Museum staff and visiting scientists can efficiently use this magnificent resource, which is expected to take its place as one of the most renowned and useful of its kind. ■

HOLIDAY SCIENCE LECTURES

(*Continued from page 5*)

of mental processes with a report on molecular organization and cell function, molecular information processing and molecular neurology. His final subject was "The Science of the Mind: A New Synthesis." Each lecture was followed by a lively question-and-answer period.

The Holiday Science Lectures, now in their third year at the Museum, afford outstanding high school students an opportunity to hear first-hand reports on work being done by eminent scientists of the nation.

The lectures are presented nationally by the American Association for the Advancement of Science in cooperation with scientific institutions in major cities across the country, under a grant from the National Science Foundation. ■

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

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Museum News

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INTERNATIONAL PHOTOGRAPHY EXHIBITION

THE TOMATO hornworm on the cover, photographed by John Kohout of LaGrange Park, Illinois, is an example of the outstanding camera work that can again be seen at the Museum during the 20th Chicago International Exhibition of Nature Photography. Sponsored by Chicago Natural History Museum and the Chicago Nature Camera Club, the competitive exhibition will run through February 21, 1965. Color transparencies will be projected on two Sundays, February 7 and February 14, at 2:30 P.M. in the Museum's James Simpson Theatre.

A panel of five judges selected the photographs and slides from thousands of national and international entries and assigned awards to the most outstanding. Museum staff on the panel are: Dr. Fred M. Reinman, Assistant Curator of Oceanic Archaeology and Ethnology, and John Bayalis, Division of Photography. The other judges are Samuel W. Kipnis and Julius Wolf, well-known photographic exhibitors, and Mrs. Isabel B. Wasson, noted naturalist, lecturer, and photographer.

MARCH PROGRAMS FOR CHILDREN

TWO SATURDAY programs for children will be presented in March at the Museum under the auspices of the Raymond Foundation. On March 6, Camp Fire Girl Day, the theme, "Indian America," will be explored through color movies on Indian life in the forests, plains, and deserts. Following the program, direction sheets will be available for children interested in exploring related Indian exhibits in the Museum. On March 27, awards will be given to youngsters who participated in the Museum's Journey Program in the past year. Free and open to all children, the programs will begin at 10:30 A.M. in the James Simpson Theatre.

STAFF ACTIVITIES

A SUM OF $32,100 has been awarded to Dr. Louis O. Williams, Chief Curator of Botany, by the National Science Foundation for continuation of his botanical field work in Central America during the next two years. Dr. Williams is currently in Central America collecting specimens and data on the little known plants of that region (see page 7).

DR. RAINER ZANGERL, Chief Curator of Geology, has been elected president of the Society of Vertebrate Paleontology.

KENNETH STARR, Curator of Asiatic Archaeology and Ethnology, has been appointed a member of the Committee on Far Eastern Civilizations at the University of Chicago. This follows his appointment last year to the University's Committee on Southern Asian Studies. Dr. Starr is one of several Museum staff members who, through appointment to university faculties, participate in the teaching and supervision of doctoral candidates in the Museum fields of interest.

FRED M. REINMAN, Assistant Curator of Oceanic Archaeology and Ethnology, has been awarded the degree of Doctor of Philosophy in Anthropology from the University of California (Los Angeles).

Dr. Reinman is interested in the interrelationships between environment, culture, and technology. His doctoral thesis is an investigation of the ways in which oceanic peoples have developed increasingly successful fishing techniques and implements to exploit the sea as a source of food.

CHIEF CURATOR of Zoology Austin L. Rand has written the section on gnatcatchers and kinglets for a new book, *Song and Garden Birds of North America*, just published by the National Geographic Society.

DR. RUPERT L. WENZEL, Curator of Insects, and Mr. Henry S. Dybas, Associate Curator, attended the national meetings of the Entomological Society of America, held in Philadelphia. Dybas served on the program committee and as chairman of the section on general entomology. Wenzel moderated a symposium on "Past Climates and Present Distributions of North American Insects."

DR. GABRIEL EDWIN, Assistant Curator of Vascular Plants, spoke on reproductive mechanisms in plants at a meeting of the Illinois State Society of Microscopists.

GEORGE I. QUIMBY, Curator of North American Archaeology and Ethnology, gave two speeches recently on his studies of the Indians and archaeology of the Upper Great Lakes Region from 1600–1820. One lecture, on Indian villages, was given at the School of Architecture at the University of Illinois at Chicago. The other was presented at a workshop on archaeology sponsored by the Illinois Archaeology Survey and held at the University of Illinois at Urbana. Later Mr. Quimby returned to Urbana to conduct a seminar on ecological causality and culture for the Department of Anthropology. ■

Spring Film Programs

ON NATURE AND PEOPLE AROUND THE WORLD

THE 123RD SERIES of free illustrated lectures for adults will be presented in the James Simpson Theatre on Saturday afternoons during March and April. The lectures begin at 2:30 P.M.; seats are reserved for Members until 2:25 P.M. Following is the complete schedule of programs.

Old meets new in Clifford J. Kamin's film on Mexico to be shown March 20.

March 6

Ranching It in California

Albert J. Wool

Overlooking the ocean from California's Santa Cruz Mountains is a beautiful country of rolling hills, towering redwoods, and clear mountain streams—a "land of heart's desire" such as city dwellers long for but seldom attain. The first film in the Museum's spring series offers a chance to get away from it all as Albert Wool treats us to a portrait of the joys and wonders of western ranch life. Filmed on his own 1,300-acre cattle ranch on the Pacific shore, his motion picture follows the farming and ranching operations from planting time to hay harvest, from calving time to roundup. Along the way you will enjoy bountiful wildlife, take to the surf on horseback along the Pacific, and see the action at junior horse shows and rodeos where youngsters compete for fun and glory.

March 13

North to Hudson Bay

David Jarden

Twenty times in as many years, David Jarden and his Indian guides have pitted their frail canoe against the caprices of nature in Ontario's vast northland. This time his film records an 850-mile trip down the Winisk River to Hudson Bay, along the coast, and then by inland canoe route from James Bay to Moosonee. Captured in natural color are the wildlife, fishing, Indians, woodcraft, and beauty of the great forests that cover this northern region. It is a strange hinterland, bright with a myriad of wild flowers. You will see caribou graze at will, watch thousands of Canada geese gather for their fall migration, experience the finest fishing, thrill to shooting rapids.

March 20

Mexico—On the Trail of Cortes

Clifford J. Kamen

Few men in history have approached the remarkable achievement of Hernando Cortes. Clifford Kamen's film follows the great adventurer's invasion route into Mexico and tells the almost unbelievable story of the conquest of the Aztec empire. But the film not only recreates the past; it also offers a fresh interpretation of contemporary Mexican life as it has been affected both by its Mayan and Aztec traditions and the introduction of Spanish culture. Mr. Kamen's well-known animated maps and art work add a unique dimension to this fascinating portrayal of Mexican history and culture.

(*Continued on page 8*)

THE NEW
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IN SPEAKING of a museum science department as an organism with definite structural parts and functions, I am aware of the limitations of the metaphor. But such a department is an organism of sorts, and as such it has superficial similarities with real organisms. For example, science departments do evolve, thereby increasing in physical and functional complexity; they also tend to suffer as a whole if one part within them malfunctions; as in real organisms, changes in one part of the body have to be in harmonious relation to the rest if the whole is to function properly. All these things are pertinent to an understanding of the vast changes that are currently under way in the Department of Geology.

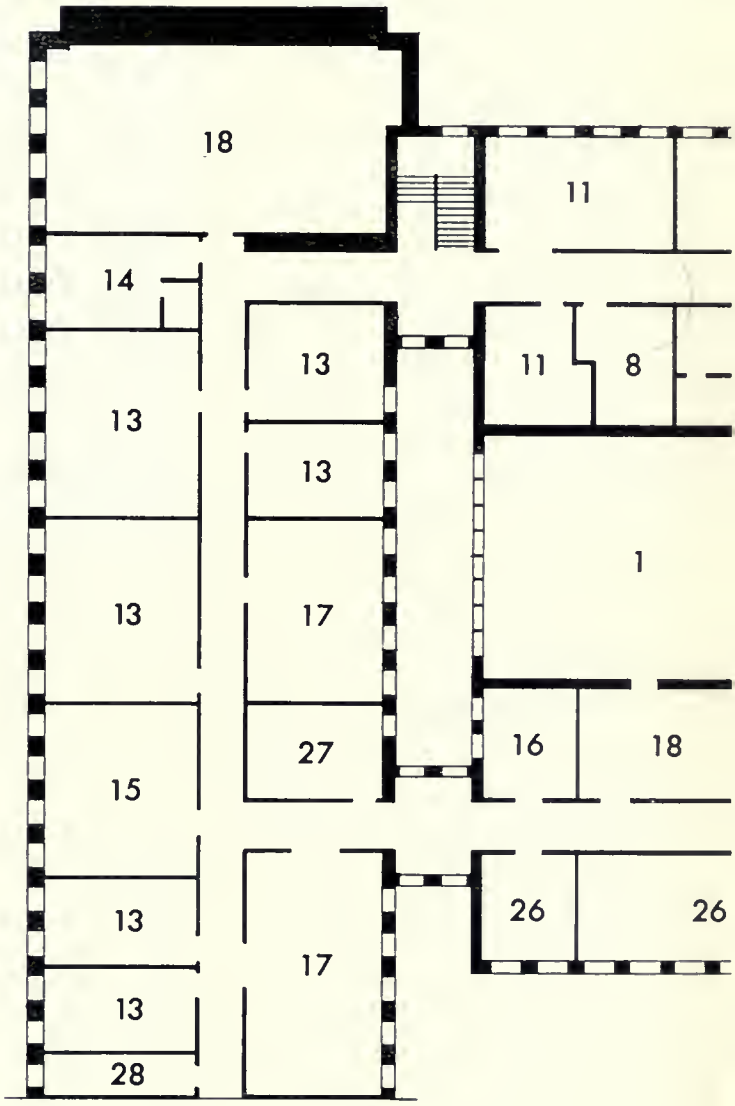
The early evolutionary history of the department consisted primarily of (1) filling its maw with food, in the form of collections (in contrast to real organisms, museums ingest a lot, digest some, but eliminate very little); (2) adding brain cells (curators and assistants); and (3) building up the sensory apparatus, in the form of microscopes and a host of other tools for investigation. Since the overall size of the body was clearly defined and limited to the third floor of the northwest quadrant of the Museum building, and since the acquisition of items 1 to 3 above spanned a developmental period of some 69 years, it was no great surprise to discover that the body would hold no more. As a matter of fact, the collections of fossil invertebrates, fossil plants, and rocks had grown well beyond the storage capacity, with the result that large numbers of specimens could no longer be properly housed and had to be kept under tables, on top of tables, and inaccessibly piled on top of storage cases. Even worse, vital research equipment had to be installed in various nooks and crannies all over the department.

Organisms such as domestic dogs and, even more so, man himself are prone to overindulge if tempted with gloriously succulent vittles, and such a fate befell the Department of Geology when it was faced with the prospect of taking over the famous collection of fossil invertebrates in the Walker Museum of the University of Chicago. The motivation was not all greed, however. Many arguments leading to the decision that this vast collection should come to the Museum had merit beyond the simple and defendable proposition that a museum collection is the more useful to scientific inquiry, the larger it is.

It was perfectly clear at the outset that if this collection were to be accepted the organism would have to undergo further physical growth to nearly twice its former size, and along with this a complete metamorphosis: namely, a profound redesigning of the parts. At this writing the department can best be described as a disaster area. There is building and rebuilding going on everywhere while the former contents of the department have to be shunted here and there as dictated by the demands of the construction. But now the new shapes begin to appear and we can recognize the look of the future.

To begin with, the collections, formerly stored in various rooms along the corridors of the third floor research area,

(*Continued on page 6*)

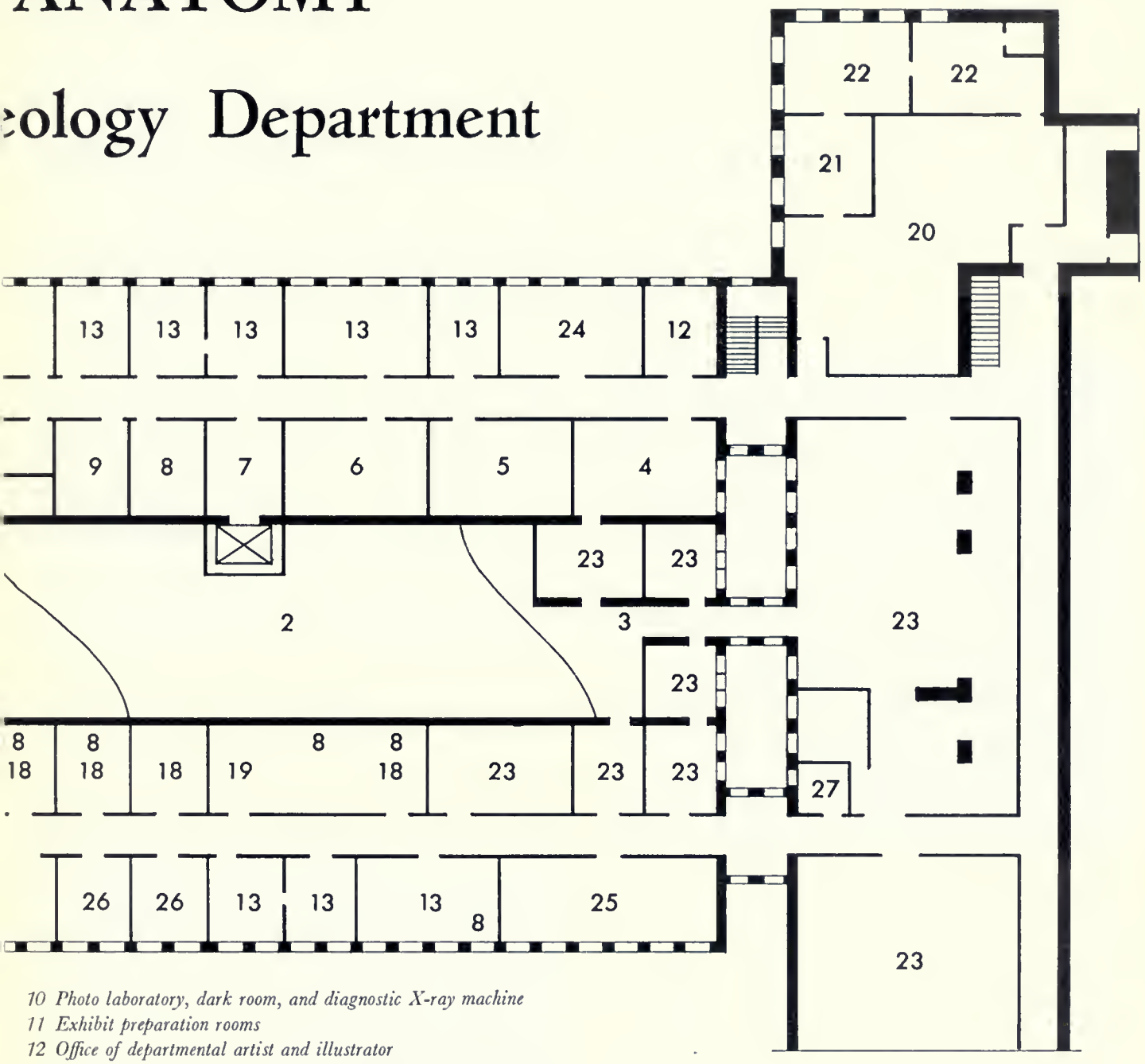


1 Second floor collection storage area
2 Mezzanine collection storage area
3 Third floor stack room, General Library
4 Geology map room
5 Geochemical laboratory
6 Rock-sectioning laboratory
7 Shipping and receiving room and elevator
8 Student and assistant offices and study areas
9 Thin-section laboratory

RAINER ZANGERL
Chief Curator, Geology

ANATOMY

:ology Department



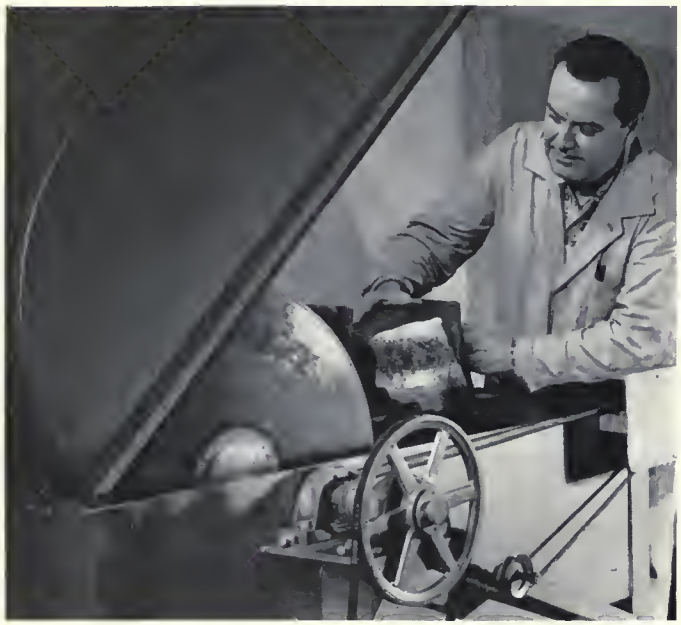
10 Photo laboratory, dark room, and diagnostic X-ray machine
11 Exhibit preparation rooms
12 Office of departmental artist and illustrator
13 Offices and workrooms of curators, University of Chicago professors, assistants, and visiting scientists
14 Chalmers X-ray spectrograph laboratory
15 Divisional paleontology library
16 Maurice L. Richardson fine-preparation laboratory
17 Preparation laboratories
18 Collection areas for biostratonomy, fossil fishes, fossil amphibians and reptiles
19 Classroom
20 Geology library

21 Geology office
22 Office and workroom of Chief Curator
23 General Library
24 Museum artists
25 Editors of scientific publications
26 Harris Extension
27 Washroom
28 Supply storage
(Drawing by Lido Lucchesi)

are to be put into an enormous central hold, a space created by filling in the light well that was formerly enclosed by the departmental quarters. The study collection will occupy approximately two-thirds of the 252,000 cubic feet of new space; the balance will become the stack room and some offices of the General Library. Large as it is, the new storage range does not accommodate all the collections of the Geology Department; biostratonomy as well as fossil fishes, amphibians, and reptiles either remain where they now are, or will be moved to storage rooms adjacent to the former well.

As is true of any biological metamorphosis, the reorganized anatomy is, in part, a compromise with the old. This came clearly to our attention when we worked on the plans for the research area. There were many limitations imposed by the building in its former condition, and it was not possible to achieve an ideal solution in all respects. Ideally,

Assistant Henry Horback prepares specimens for study in the rock-sectioning laboratory.



all offices should have access to natural light; ideally, curators should be close to their collections, the laboratories they most frequently use, and the specialized libraries they most often consult. While these and many other considerations could probably be satisfied if one were to design a structure from the ground up, it soon became obvious that the layout of the present building would not accommodate them.

The new plan, however, will be a functional organism, and such compromises as had to be made were mostly ones of convenience rather than efficiency. Curators will have offices combined with adjacent work rooms, permitting them to keep acid bottles and specimens off their desks (see plan for location of offices along the outer wall of the building). Only one laboratory, the Chalmers X-ray spectrograph laboratory, was placed along the outside walls of the building in order to remove it as far as convenient from possible vibrations produced by the air-conditioning plant at the bottom of the former well. Because there will be a concentration of paleontologists in the west half of the department, a divisional paleontology library is also located there.

On the north side adjacent to the former well there will be mostly laboratories, as follows: the geochemical laboratory (in its present location), a rock-sectioning room that will house the different rock-cutting devices, a thin-section laboratory, a photo laboratory with dark rooms and diagnostic X-ray machine, and a shipping and receiving room next to the elevator that will service the hold in the interior of the former light well. This room will be used to unpack crates that are shipped in from the field and for packing or unpacking shipments of specimens being sent for study to or from other institutions. Furthermore, there are two offices to be used by students and assistants, and a shop to serve in connection with the preparation of exhibits.

On the south side adjacent to the former well there will be the Maurice L. Richardson fine-preparation laboratory, equipped with instruments that permit the cleaning of extremely delicate fossils. A large portion of the fossil fish collection will be housed on this side, and a classroom where Professors E. C. Olson and Ralph G. Johnson of the University of Chicago and various members of the curatorial staff expect to teach and hold seminars. Student cubicles for graduate students engaged in thesis work are located in a number of places.

Finally, there will be changes in the area of the departmental library, the departmental office, and the office of the Chief Curator. By removal of the semipermeable membranes that now partially subdivide the geology library, a very notable gain in capacity will be effected. The geology office will be moved to what is now the map room, and the Chief Curator will gain a workroom of his own (he intends to continue to do research).

In summary, the Department of Geology will have a new anatomy, a new size, and, hopefully, a revitalized efficiency.

Dr. Tibor Perenyi, Departmental Artist, discusses an exhibition model with Dr. Eugene S. Richardson, Jr.

The high volcanoes of western Guatemala have a fair cover of virgin forests which contain plants still unknown to botanists.

LOUIS O. WILLIAMS
Chief Curator, Botany

PLANTS WITHOUT NAMES

One of the first things that an observant person wants to know when he goes to a new region is the names of the conspicuous and more important plants around him, especially if those plants affect his everyday life, or even make life possible.

Although the naming of plants is as old as man, the systematic study of the world's vegetation, with an attempt to attach precise scientific names to each of the kinds of plants in the world, has been going on for only a little more than two hundred years.

There are in the temperate and arctic regions of North America perhaps some ten thousand species of flowering plants. These are quite well known, and most of them have been given scientific names.

In the tropics of the Americas, however—in that region between the Tropic of Cancer and the Tropic of Capricorn—vast expanses still are relatively unexplored. Areas as large as Illinois have never been lived in or studied by a botanist the year around. The whole of Nicaragua, which is right on our door step in this travel-by-jet era, is mostly unknown botanically.

Of the flowering plants alone, it is estimated that there are some 100,000 to 125,000 known species in the American tropics. Capable botanists studying the flora of these regions think that as many as one out of every four of its flowering plants may still be unknown and unnamed. If this estimate is correct, then there should be some 130,000 to 180,000 kinds of flowering plants in the neotropics.

Ferns, algae, fungi, mosses, and liverworts are other great groups of plants found in our tropics. No one knows how many kinds of these plants there are, and our scientific knowledge of them is much less, even, than of the flowering plants. It is possible—even probable—that there are more kinds unknown to science than are known.

Exploration of our tropics and research on the vegetation proceed hand in hand. It will be a long time before the vegetation of the American tropics is as well known as, for example, that of the United States. To place the problem in perspective: it has been estimated recently that it would take one hundred botanists one hundred years just to carry on the exploration and study necessary to compile a flora of neotropical flowering plants.

Progress in many other sciences depends upon a knowledge of the plants and vegetation that cover the face of the earth. Research in the botany of the American tropics is an open field beckoning to those who would participate in a scholarly science in which exploration and discovery make living enjoyable and rewarding. ■

Spring Film Programs

(*Continued from page 3*)

March 27

Man Looks to the Sea

Stanton A. Waterman

For a new and challenging horizon, many Americans in their characteristic search for adventure are looking to the sea. Through a series of brilliant, full color film sequences, we can share Stanton Waterman's exploration of this strange milieu. He shows us divers risking their lives in the blue depths of the Pacific to harvest precious black coral; the attack patterns of the shark, spectacularly photographed from an underwater cage only eight feet away; a wild wrestling match with a timid, tenacious octopus tickled out of its den; a dazzling marine collection of rare and colorful reef fish in the out islands of the Bahamas. Highlights of the film are underwater shots of the incredible leaps made by the porpoises at feeding time in the Miami Seaquarium, and the actual sound track of porpoise "talk."

April 3

Trailing Lewis and Clark to Oregon

Thayer Soule

In 1803 the Louisiana Purchase more than doubled the size of the United States. President Thomas Jefferson persuaded Congress to authorize an exploration of the new territory, from Cahokia, Illinois (then an American outpost on the east bank of the Mississippi) all the way to the Pacific. Everyone knows how Lewis and Clark were chosen for the task and how Sacajawea, an Indian girl, was instrumental in their success. Now this stirring phase of American history comes to life in a film made almost entirely within ten miles of the actual Lewis and Clark route. The motion picture not only tells the story of the historic expedition, but shows the undreamed of changes that have occurred in the territory during the 160 years since Lewis and Clark forged their way to the sea.

Turkish girl from Gene Wiancko's "The Ancient World—Athens to Cairo."

April 10

The Ancient World—Athens to Cairo

Gene Wiancko

From Athens to Cairo is a distance of only 700 miles; yet within a circle enclosing these two cities were enacted many of history's greatest epics. Here, the still-magnificent relics of mankind's ancient glories stand in a living world of beauty and charm. In our film journey from Athens to Cairo we cross the paths of Jesus and Mohammed, Socrates and Alexander the Great, Suleiman the Magnificent and the crusaders, Phoenicians and pharaohs, King Tutankhamun and King Paul. The ways of life in the eastern Mediterranean world today are movingly portrayed, and even the ancient world seems to live again.

April 17

Waterway Wildlife

Karl Maslowski

The complete dependence of man and wildlife upon an abundance of good fresh water is the theme of this dramatic color motion picture. A woodchuck browsing on a hilltop meadow; bass spawning in a limestone creek; factory workers turning out steel, glass, and cloth—all rely equally on adequate supplies of uncontaminated water. A noted naturalist and conservationist, Karl Maslowski contrasts the areas devastated by man with the beauty of still unspoiled waterways and their wildlife communities. We hear the voices of such waterway dwellers as tree frogs, wood ducks, and Canada geese, and glimpse the families of red fox and muskrat, cottontail and deer.

April 24

Hiawatha Country

Fran William Hall

Longfellow's image of Hiawatha's country is one of timeless appeal. An area of soaring mountains and sparkling waters, it is one of America's last great wilderness regions. Today ore boats ply the Gitche Gumee, and remote villages, almost forgotten by time, are emerging into modern life. Fran William Hall captures the spirit of this land in a film that shows us the glorious Lake Superior "circle," the fabulous iron country around Duluth, Ontario's mooselands, the top of the Soo, Michigan's Upper Peninsula, famous Pictured Rocks, Copper Harbor, and the vast north woods. ■

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 36 No. 3

March 1965

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

Cover From New Photographic Exhibit

THIS MONTH'S cover—a delightful photographic study of a Korean boy imprinting his footsteps on the mud flats of his native countryside—is from a new exhibit titled "The Character of Korea" opening at the Museum on April 1. In 55 black-and-white photographs, the exhibit depicts the beauty and character of Korean rural life at the present time.

The exhibit is sponsored by the American-Korean Foundation, a private, non-profit group which undertakes projects in Korea in the fields of culture, education, health, welfare, and economic development. The pictures are the work of the widely-known artist-photographer Wallace C. Marley, motion picture coordinator for the United States Department of Defense. The exhibit comes to the Museum in the course of a two-year, nationwide tour.

More than a million Americans have visited or seen military service in Korea since its liberation from Japanese rule in 1945, but few of these have seen the country except under the chaotic conditions of war. "The Character of Korea" provides a unique opportunity to experience the ancient traditions of rural life in peaceful, primitive farm villages; to explore the countryside; and to enter more deeply into the spirit of Korea itself.

Paleontology Library

ON THE day after Christmas, 1945, a $500 contribution arrived in the mail from a Lansing, Michigan, radiologist, Dr. Maurice L. Richardson, who wrote of his appreciation for the many pleasant afternoons he had spent studying the Museum exhibits. Since the donor expressed interest in vertebrate paleontology, his gift was set aside in a fund to support paleontological research. From this beginning, the Maurice L. Richardson Paleontological Fund has developed and grown through consistent and increasingly generous contributions by Dr. Richardson.

Maurice L. Richardson

The income from the fund has been used for the purchase of specimens and laboratory equipment, but primarily for field work—in Illinois, Indiana, Wyoming, Montana, Utah, Arkansas, Connecticut, Alberta, Quebec, and Australia. The collections thus made have been the basis of years of staff research, and from the research have come, and will come, many scientific publications.

As the fund and its scientific productivity have increased, so has the interest of Dr. Richardson, who visits the Museum several times each year to chat with the curators and the Director, catch up on current research and scientific publications, and pick up a few books in The Book Shop to satisfy his omnivorous reading appetite. Seldom in the history of the Museum has anyone taken as personal and sustained an interest in the work being aided by his contributions.

The Board of Trustees, wishing to honor Dr. Richardson, sought a suitable means of doing so. As new construction and remodeling of the Department of Geology has progressed, and as the new paleontology library took shape, it seemed eminently fitting that this library be named in his honor. Thus, at its January meeting, the Board designated it the "Maurice L. Richardson Paleontological Library." Space was allocated on the west side of the third floor, and hopes are that the library will be fully installed and equipped by the time of Dr. Richardson's fall visit. Future students and scientists will find the rich resources of this library a well-suited tribute to one who has so generously aided the researches which the library contains.

(ELW)

Norman W. Nelson

Business Manager

ON FEBRUARY 1, Mr. Norman W. Nelson was appointed Business Manager of Chicago Natural History Museum. In this newly created position, administrative responsibility will be delegated to Mr. Nelson for the business and financial operations of the Museum. In addition, certain personnel and other operational matters, including the operation of the Museum building, will come within the jurisdiction of the Business Manager. Mr. Nelson will work with present department and division heads in the conduct of his office. The scientific and educational departments; the library; and the public relations and membership divisions will

(*Please turn to page 8*)

Net-fishing in the lagoon off the northern coast of New Guinea

Fred M. Reinman, Assistant Curator
Oceanic Archaeology and Ethnology

FISHING IN OCEANIA

SINCE very early times, the sea has been a source of food for peoples fortunate enough to live along its margins. In many areas, fishing, the gathering of shellfish, the hunting of different kinds of sea mammals, and the capture of turtles have furnished important supplements to a diet of terrestrial plants and animals.

The earliest firm evidence for the use of food from the sea comes from the Mousterian site of Devil's Tower in Gibraltar, where limpets and mussels were recovered from nearly all levels of the excavation. Even earlier evidence of the use of fish is said to come from Africa, and fish remains have also been found below a dated level of 40,000 years ago at Niah Cave in Borneo. These remains, however, apparently refer to fresh-water varieties of fish and indicate that at this early time the sea had yet to become an important source of food. At later periods, beginning in the Mesolithic, large shell mounds are known from many areas of the world. These mounds contain many kinds of shellfish, fish bones, and the remains of other aquatic animals from both fresh and salt water, which indicate an increasing utilization of the aquatic resources of man's environment.

In addition to faunal remains, the archaeologist also finds tools indicating the importance of the aquatic environment as a source of food. These finds—although rare in the early

(*Continued on next page*)

periods—begin in the Upper Paleolithic. By Mesolithic and Neolithic times, they include nearly the entire range of fishing and sea hunting equipment: harpoons, gorges, stone net and line sinkers, fishhooks, net fragments, traps, hook-making implements, and many others.

From the simplest shoreline gathering (sometimes called strand-looping) to the more highly complicated techniques for sea mammal hunting and fishing, methods for taking food from the sea were developed gradually over a long period of time. Probably the earliest was to take fish or shellfish by hand, or, at most, to use a simple pointed or sharpened stick to spear or prize the quarry from the rocks or water. Sea mammals and turtles which periodically came ashore could also be taken quite easily with simple implements such as clubs, knives, ropes, and spears.

Among these early foods from the sea, shellfish has continued to play an important part in the diet of many peoples. However, as a staple food source, shellfish collecting is generally associated with a relatively low level of cultural attainment. Among primitive groups that actively fished or hunted sea mammals, shellfish played only a minor dietary role.

To exploit more fully the inshore areas of the sea, more highly developed technological devices were needed. In many cases, these were probably not new inventions, but were applied to the sea by simple transfer from land-oriented hunting activities. Examples of such devices are nets of various types, spears, arrows, clubs, traps, and perhaps the gorge. All of these implements could be used without a great deal of modification, simply requiring the addition of weights or floats to counteract or utilize the buoyancy of the water. Once these inventions or transfers had been made, primitive man gained a reliable supplement to his diet without having to leave the shallow waters of the reef or the shoreline.

Still greater utilization of the sea required two further advances: the use of some form of boat or raft, and the invention of the fishhook. With the first, man was no longer confined to the beaches and shallow inshore waters, but was able to exploit offshore areas for new foods or to capture animals that used the water as a means of escape. With the second device, the fishhook, man no longer needed to limit his exploitation to the sea's surface waters, but was now able to explore and utilize the sub-surface levels and successfully capture mid- and deep-water fish.

In Europe, neither the boat nor the fishhook appears in the archaeological record until the end of the Mesolithic period. Offshore or deep-sea fishing in Europe did not really become effective until after the advent of the Neolithic and the beginning of farming. With the growth of towns and large populations, the demand for products of the sea resulted in a more efficient fishery, which included deep-sea fishing, as well as whale and other sea mammal hunting.

This general sequence of events in world prehistory can also be traced in the archaeological records of localized cultures. When men enter a new area having access to the sea, they will generally make increasing use of this aspect of their environment once it is recognized as a potential source of food. Any lessening of available food supplies from the land can also stimulate this turning to the sea, and in Oceania we have an example of this. As groups migrating out from the Asian mainland left behind the large islands of Indonesia and New Guinea and began to populate the smaller Oceanic isles, they found that the abundance of land flora and fauna decreased from west to east. Hunting and the gathering of wild plants yielded less and less food. On the low atolls, the possibilities for horticulture were restricted to tree and root crops. The difficulties of maintaining adequate supplies of pig, dog, and chicken were such that, by the time the easternmost areas of Polynesia were settled, man's dependence upon the sea as a source of protein had become very great. In eastern Polynesia the number of sea fishing and hunting techniques employed testifies to the importance of sea food to these islanders.

The wide variety of implements used by the primitive Oceanian in his quest for food included nets of all kinds, permanent stone and portable basketry traps of different shapes and sizes, weirs and fish fences, spears and fish arrows, the harpoon, fish poisons, and, in most areas, the fishhook. If we divide the potential fishing area of an Oceanic island or atoll into two major zones—inshore and offshore—and further divide these zones according to the layers of the water in which the various fishing implements are used—surface and subsurface—we may then analyze the fishing techinques and implements used at each level of each zone (Fig. 1.) Such an

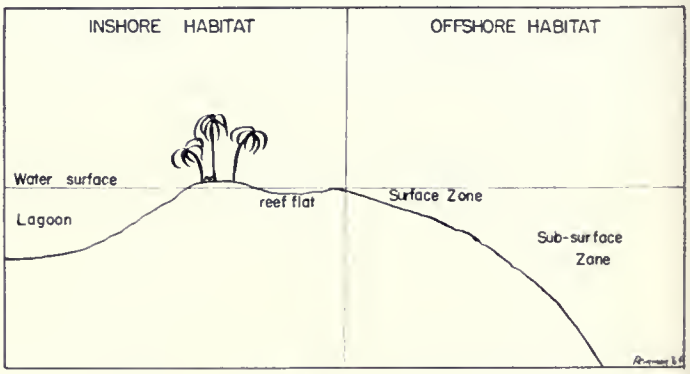

Fig. 1. Schematic cross-section of atoll.

analysis soon makes clear that the prime target of the Oceanic fisherman was the surface waters of inshore reefs and lagoons. This area produced most of the sea food the islanders used.

Relatively few types of fishhooks were used to exploit these shallow waters. The Oceanic spinner hook (Fig. 2), especially designed for taking bonito and closely related surface feeding fish, and the gorge (Fig. 3), were the main implements. The Oceanic spinner hook varied only in detail over the whole area of its use. It consisted of a shank, fish-like in form, made from some type of pearl or other shiny shell material. In areas where pearl shell was scarce, other materials, such as bone, wood, or stone, were used; in such cases a thin layer of pearl or other shell was usually affixed to the shank, presumably to act as a lure. Attached to the shank was a point made of bone, pearl, turtle, or other shell (later metal), which was

unbarbed for easy removal of the fish. The spinner hook was used without bait and trolled behind a moving canoe.

In Oceania the gorge, like the spinner, was primarily used in the surface layer of the sea. The gorge is a very old but effective catching and holding device, which archaeologically precedes the fishhook and which has been retained in many areas where fishing with hooks is also done. It consists of a slender wooden stick or bone splinter, pointed at each end, with a line attached to its center. When baited, the gorge is set so that it lies closely parallel to the line. When the fish swallows the bait, the tension on the line pulls the gorge crosswise in the fish's stomach, piercing its sides and effectively preventing the fish's escape. Gutting is usually required to remove the gorge, and the fish is rarely able to pull himself free. Since the gorge is more effective than the hook in holding the catch it would seem to be the best choice for devices that are left unattended, such as the lines of floats used to take flying fish. This is its greatest use in Oceania.

To catch fish that fed in the sub-surface layer of the lagoon and in the deep waters of the offshore zone, many types of fishhooks were made from pearl, turtle, and coconut shell, or from bone, wood, and occasionally teeth (Fig. 4). Such hooks were baited, and generally used with a hand-held line rather than a pole. Either permanent or temporary sinkers were added to get the hooks to the proper depth for fishing. Differences in the size and shape of these hooks suggest that their makers had rather specific ideas about the types and sizes of fish that could be taken with each.

A still more specialized instrument is the ruvettus hook (Fig. 5), named for the deep-dwelling species, *Ruvettus*, which it was designed to catch. The ruvettus hook was made in a range of sizes from about six inches to over a foot in length. A U- or V-shaped forked branch of a tree forms the shank and point leg of the hook. Fastened to this is a V-shaped point of wood which forms a barb directed back toward the shank, reducing the clearance between point and shank to less than an inch in the larger hooks. The ruvettus is set in depths of up to 2,000 feet, with bait and a sinker attached to the line. In attempting to remove the bait, which is affixed to the point leg, the fish works his jaw between the point and the shank and is firmly secured. Similar hooks were used to take sharks.

A knowledge of the kinds of fishing equipment used by prehistoric fishermen, the zones in which these implements were used, and the kinds and amounts of fish taken with them, is important for the Oceanic prehistorian. Fishing equipment constitutes an important category of implements recovered from the archaeologist's excavations. It is necessary to have some idea of how such equipment functions in a culture in order to make valid inferences about the diet, social organization, and general economic conditions of the makers of the equipment. More specifically, analysis of different types of fishhooks contributes evidence as to the way in which the marine habitat was exploited in Oceania, and, taken in conjunction with the rest of the fishing complex, will enable the archaeologist to make more precise interpretations of the role of fishing in the Oceanic economy. ■

Fig. 2 (above): Oceanic spinner hooks. Sizes range from 3 to 4 inches.

Fig. 3 (right): Gorge. The slender bone splinters swallowed by the fish are at the bottom of the photograph. These splinters are 1½ to 2 inches long. Larger ones may approach 6 inches.

Fig. 4 (above): Fishhooks used below the surface of the lagoon or in deep offshore waters. Sizes range from 2 to 3 inches.

Fig. 5 (right): Ruvettus hook.

D. DWIGHT DAVIS

1908–1965

DR. DWIGHT DAVIS, Curator of Anatomy, died February 6th at the age of 56. He was at the height of his career as a comparative anatomist when his monumental work on the giant panda was published just two months before his death.

As a biological discipline, comparative anatomy is an old field that had its time of intensive work and glory in the past century. Its history is studded with such famous names as Cuvier, Gegenbaur, Fürbringer, Wiedersheim, Owen, Goodrich, and many others. The technical literature in the field is all but overwhelming in its extent. Under these circumstances one may legitimately ask whether a man can still make an outstanding contribution in this discipline and measure up to some of the illustrious scientists of the past. I think Dwight Davis did make a major contribution and his name will rank among the foremost comparative anatomists of the 20th century.

My reasons for this near-prophetic statement stem from my close acquaintance with Dwight's character and work habits. He was a perfectionist in all his endeavors, and his work habits can best be described as meticulous. Moreover, he was not content merely to build upon the philosophical foundations and the methodology of his science, as they had been laid out by his predecessors, by pragmatically adding to the body of knowledge. Instead, he felt that the time had come for the field to explore new vistas and to undergo a change in direction. Characteristically, he prepared himself before he ventured to put his ideas on paper; he read and even translated a large part of the exceedingly difficult German literature that deals with the philosophic foundation of the science of comparative anatomy and the history of the discipline, as a first step toward an assessment of what the future role of his science should be among the ever-growing family of biological sciences.

Then he proceeded to test his ideas, developed over many years, on a problem close at hand, the comparative anatomy of the giant panda. His anatomical work on this animal dates back to the late thirties, and began with a windfall: in 1937 the Chicago Zoological Park acquired Su Lin, a giant panda that lived there until April, 1938. When Su Lin died, its body was embalmed and injected at the Museum. Davis's original purpose was merely to establish its systematic relationships, which were still under dispute at that time. This question was soon settled, and replaced by problems of far broader biological significance.

By the mid-fifties most of the anatomical and comparative anatomical evidence was at hand and Davis had established beyond reasonable doubt that the giant panda is a bear. But it is not merely another bear; it is, structurally, an "exaggerated" bear. What brought about these differences? Could the field of comparative anatomy contribute to such a question? Davis thought that it could; although he utilized insights gained in other biological disciplines, he nevertheless felt that the comparative anatomical contribution was most important and fundamental. In a marvelously well-written introduction to his memoir on the giant panda he has set forth his ideas on the potential power of comparative anatomy as an explanatory science.

Dwight Davis was born in Rockford, Illinois, on December 30, 1908, the son of a minister. Already as a boy he had an interest in natural history, and especially in animals. He was educated at North Central College in Naperville, and did some graduate work at the University of Chicago Medical School. In 1930 he started his career at what was then the Field Museum of Natural History as an assistant in the Division of Osteology, and in 1941 he became Curator of Anatomy. Under his curatorship the Division of Anatomy became well known all over the country and even abroad, and it served as the meeting place for scientists of a broad variety of specialities.

Davis's scientific interests did not lie exclusively in comparative anatomy. In the early part of his career he worked and published on herpetological topics. Later on he felt the need, in connection with a growing interest in functional anatomy, for first-hand observations of animals in the field; thus he took part in a number of expeditions, most notably one to North Borneo in 1950 which resulted not only in many important observations, but in a very fine systematic study of the mammals of the lowland rain forest of North Borneo. In all, Davis published over 50 scientific papers, and numerous semi-popular articles and book reviews.

Dwight was not a gregarious person; he felt ill at ease in large groups and would usually seek out one or two persons with whom he felt a community of interest. He also abstained from conversation unless he had something worthwhile to contribute; he saw no sense in talk for its own sake. As a colleague he was often difficult, unap-

proachable, sometimes caustic. But these were, so to speak, the work-a-day clothes of his character; beneath them was an entirely different man, congenial, friendly, even warm, but only his closest friends ever really knew this side of Dwight's personality. Those of his colleagues who did not know him well nevertheless admired him and respected the quality of his intellectual capabilities. He was especially envied for his talent at organization and the polish of his performance, which were particularly evident in the delivery of an address or a lecture. These attributes were clearly the result of the fact that Dwight would never do anything casually. It was either done right, or not at all, and, true perfectionist that he was, he never quite satisfied himself with the quality of his own accomplishments. Contrary to what might be supposed, Dwight was always ready and eager to cooperate with others in both professional and leisure-time projects.

During the late forties Davis became a photographer. It looked like a hobby, but was much more than that. To him it was a pleasurable means of recording and documenting observations, especially of phenomena related to natural history. For this purpose he made use of still as well as motion pictures.

Although Dwight Davis was not a regular university professor, he supervised graduate training of a number of students at the Museum, was appointed Lecturer in Zoology at the University of Chicago in 1950, held a visiting professorship at California Institute of Technology during 1954, and served as acting chairman of the Department of Zoology of the University of Malaya during the fall and winter of 1962–63. In 1958 he was invited as a participant to the International Biological Congress at the University of Malaya at Singapore in celebration of the centenary of the formulation of the theory of evolution by Charles Darwin and Alfred Russel Wallace.

Davis was a member of several societies: the American Society of Mammalogists, of which he was a trustee during 1955–61; the American Society of Ichthyologists and Herpetologists; the Society for the Study of Evolution, which he served as managing editor of the journal, *Evolution*, since 1961; and the American Society of Zoologists, which appointed him chairman of the Division of Vertebrate Morphology during 1961–62.

His Alma Mater, North Central College, conferred upon him an honorary degree of Doctor of Science in 1963 in recognition of his outstanding work as a comparative anatomist.

Dwight Davis will be missed on the staff of the Museum, as elsewhere. He left a profound impression on those who maintained close contact with him; the impact of his ideas and his personality survives among those of us who treasure the good fortune of having known him.

Rainer Zangerl
Chief Curator, Geology

Anasazi Indian ritual. From exhibit seen on Spring Journey.

NEW CHILDREN'S JOURNEY

APACHE, Pima, Pueblo, Navajo—all are Indians of our Southwest desert country. Yet each tribe met the challenge of desert living in a different way. "Indians of the Desert Country", Chicago Natural History Museum's spring Journey, will give children a glimpse into the lives of these Indians.

Sparse vegetation, little water, and extreme temperatures were some of the problems to be met. The Navajo Indians, as seen in detailed miniature models of their summer and winter encampments, found the answer in sheep herding—wandering with their flocks in search of forage plants. The Hohokam Indians, forerunners of the Pima tribe, however, were able to settle in one place and establish large towns as well. A diorama of one of their settlements and extensive irrigation systems that made this possible is on exhibit.

War bonnets and arrows of the Apache Indians on display indicate their traditional pattern of living—hunting and raiding.

Highlight of the self-guided Journey is a life-size reproduction of a Pueblo "apartment" interior. In it, an Indian family is busy with the daily tasks of weaving, cooking, and making pottery. Here, too, Journeyers will discover for themselves how the walls, the storeroom, and even the religious symbols seen on the wall were adapted by the Pueblo Indians to the Southwest desert country.

Many other exhibits showing the colorful rituals and ceremonies, costumes, tools, and weapons of these Indians can be seen on the Journey.

Boys and girls interested in taking the Journey may pick up information and a Journey questionnaire at the Museum doors.

The spring Journey on "Indians of the Desert Country" is available from March through May. ■

BUSINESS MANAGER

(*Continued from page 2*)

continue to report directly to the Director. Thus the creation of the position of Business Manager is essentially a restructuring of the Director's office, which will allow the Director more time to devote to institutional planning and development.

To his new position Mr. Nelson brings wide administrative experience as corporate executive and financial officer. He was associated with the Cherry-Burrell Corporation of Chicago and Cedar Rapids, Iowa, beginning as a clerk after graduation from college and rising through a number of positions to become Vice President-Finance and a member of the Board of Directors. He has also been an officer and director of associated companies manufacturing food packaging and processing machinery, both in the United States and Mexico.

Mr. Nelson was born in Stambaugh, Michigan. He received a Bachelor of Science degree in Commerce from Northwestern University in 1937, and in 1944 was licensed as a Certified Public Accountant by the State of Illinois.

He is married and the father of three sons. The Nelson family particularly enjoy the outdoors, and have camped in most of the national parks of the country. Mr. Nelson's avocation is music, and he has been active in organizing and directing several choral groups. ■

STAFF APPOINTMENTS

THE FOLLOWING staff appointments and changes have also been announced by the Director.

Department of Zoology
Hyman Marx, *Associate Curator, Reptiles*

Library
Chih-wei Pan, *Cataloger;*
Supervisor East Asian Library

N. W. Harris Public School Extension
Lido Lucchesi, *Preparator*

Division of Photography
Homer Holdren, *Associate Photographer*

Guard
George Lamoreux, *Captain*

THE TURKEY VULTURE'S SENSE OF SMELL

Austin L. Rand
Chief Curator, Zoology

VULTURES are part of Nature's sanitary corps, which also includes mammals, such as hyenas; insects, such as some flies and beetles; and bacteria. These help to remove the bodies of animals that have died in field and forest. In more primitive human societies, vultures may help remove garbage from villages.

In man's more highly organized societies, the vulture as a sanitary aide is passé. Yet Dr. Kenneth E. Stager of Los Angeles County Museum has brought to our attention a new way in which vultures have been useful to modern man. The turkey vulture in recent years has helped the field engineers of the Union Oil Company of California locate leaks in their large natural gas lines. When a leak was suspected in a pipeline in rough country where patrolling was difficult, a high concentration of the odoriferous ethyl mercaptan, attractive to turkey vultures, was introduced into the line. Subsequent patrols noted where turkey vultures concentrated along the line, went there, and found the leak.

This took advantage of the turkey vulture's sense of smell, and focuses attention on the fact that most birds are thought to have little or no ability along these lines. Whether or not the turkey vulture was an exception had been debated for over a century. Experiments had been reported that were claimed to show that turkey vultures had no sense of smell while others were reported that showed it did have one.

Obviously there was a discrepancy to be searched out. This Curator Stager has done and reported the results in a paper published in 1964 and entitled "The Role of Olfaction in Food Location by the Turkey Vulture (*Cathartes aura*)." The answer proved a very simple one. There is more than one kind of vulture. In the United States there is the black vulture and the turkey vulture. Curator Stager demonstrated very convincingly that the black vulture has no useful sense of smell and finds its food entirely by sight. On the other hand, the turkey vulture does have a sense of smell and uses it to aid its eyes in finding food. Those who reported that the turkey vulture had no sense of smell were using the wrong species in their experiments.

Curator Stager has given us another example of the importance of museum-type attention to the species and its correct taxonomy. It is basic to other fields of biological research. ■

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 36 No. 4
April 1965

Searching for evidence of marsupial evolution in Australia -- story on page 4

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

NEW STAFF APPOINTMENTS

Leon Siroto

ALTHOUGH the Museum has long possessed rich ethnological collections from many Negro African cultures, and is noted for its exhibits in this field, there has been no African specialist on the staff since the retirement of the late Dr. Wilfred D. Hambly in 1953. It is with pleasure, therefore, that announcement is made of the appointment of Leon Siroto as Assistant Curator of African Ethnology, beginning March 1.

A specialist in Negro African culture history and art, Mr. Siroto has been engaged in research on the traditional African societies, and especially their material culture and art styles, since 1950. In 1960–61, under a grant from the Ford Foundation, he carried out field research on the culture history of Negro peoples living along the Sangha and Ogowe River systems of the then French Congo (Brazzaville) and Gabon. Aided by a Fulbright fellowship, he has also made extensive studies of African ethnographic materials in the museums of England, France, Belgium, Switzerland, Holland, and Scandinavia.

Mr. Siroto has been particularly interested in investigating the premises underlying the use of masks in African societies, and the historical development of weapons by various African groups. His doctoral dissertation, based on his field research, discusses the use of masks in leadership competition among the BaKwele people of western equatorial Africa.

Mr. Siroto became an anthropologist after beginning his career an as entomologist. He received the Bachelor of Science degree in entomology from Ohio State University in 1944. In 1945 he was awarded the M.A. degree in science education by Columbia University. After several years as a Plant Quarantine Inspector with the United States Department of Agriculture, Mr. Siroto again entered Columbia University to pursue graduate work in anthropology.

Mr. Siroto has taught at Queens College and Georgetown University, and has published articles on African art and weapons. He is a member of the American Anthropological Association and a Fellow of the Royal Anthropological Institute of Great Britain.

MR. GEORGE R. FRICKE has joined the Raymond Foundation educational staff as lecturer in biology. In this position, he replaces Mrs. Maryl Andre, who has resigned.

Mr. Fricke received the Bachelor of Science degree from Wisconsin State University, at Stevens Point, Wisconsin. He did his major work in conservation and biology, with emphasis on zoology and wild life. In the Museum, he will be working in the wide range of educational programs which the Raymond Foundation offers.

EXPLORE PROGRAM FOR CULTURALLY DEPRIVED

A NEW program to explore ways in which museums can help the national effort to provide compensatory education for the culturally deprived child is now under way by Chicago Natural History Museum in cooperation with the Urban Child Center of the University of Chicago.

To develop techniques for solving this problem, Mr. Ernest Roscoe, lecturer in geology with the James Nelson and Anna Louise Raymond Foundation, one of the Museum's educational divisions, has been appointed a Research Associate in the Graduate School of Education of the University of Chicago, where he will work several days a week under the general direction of Dr. Robert D. Hess, Professor of Education and Director of the University's Urban Child Center.

The Raymond Foundation has long been concerned with making the Museum's educational resources more available to children from disadvantaged, urban backgrounds. "We must find ways to attract these young people," Roscoe said, "who may not even know that we exist, and make their visits to our halls meaningful and understandable."

During the next five months, Roscoe will visit urban schools, day nurseries, and settlement houses. He will confer with teachers, principals, and other educators, and also observe and work with the children themselves. Some of the basic questions he will investigate are: How can the Museum's educational resources (both intramural and extension) be made most useful to culturally deprived children? What kinds of natural history and anthropological materials should be developed for use with these children? What educational methods are most effective in reaching the disadvantaged at levels from pre-school through high school? Should auxiliary programs be developed for teachers and parents? How can the Museum's programs be integrated with other existing programs?

"By finding answers to such questions as these," said Miss Miriam Wood, Chief of the Raymond Foundation, "the Museum can look forward to increasing its contribution to the massive national effort now being directed toward broadening the intellectual horizons of the culturally deprived child."

STUDENT SCIENCE FAIR

SCIENCE projects designed by Chicagoland students will be on exhibit in Stanley Field Hall from 9 A.M. to 4 P.M. on Saturday May 15, during the Annual Chicago Area Science Fair. ■

MEMBERS' NIGHT MAY 7

Chocolate Tree

IF THERE are those who think that newness is not a characteristic of museums, let them come to Chicago Natural History Museum on May 7, when "What's new?" sets the theme for Members' Night.

Among the attractions of the Museum's annual open house will be: *a major exhibition hall*, now in the final stages of complete modernization; *a new conservation laboratory*, open to Members for the first time prior to its dedication later in May; *a preview of the $875,000 Museum building addition*, now at the halfway point in construction; and *a new expedition to Afghanistan*, plans for which are just under way.

When Members and their guests arrive, they will be invited to ascend immediately to the second floor, where the renovated Hall of Useful Plants awaits them. Here, in a setting made brilliant through the use of bold colors and imaginative display techniques, are the plants and plant products indispensable to man.

Among the exhibits (most are completed; some nearly so) are plant dyes—forerunners of modern, synthetic colors; resins—essential to varnishes, medicines, perfumes, plastics, and adhesives; and fibers—from which we get scrub brushes, rugs, burlap, and fine linen.

Nearby displays illustrate plants that have been dubbed "pacifiers." Some of these, like tobacco, are smoked, Others, like betel nuts, are chewed. Also shown are marijuana, opium, mescal, cocaine, and the hallucinatory mushrooms that are important in the life of many primitive societies.

Exhibits on gums depict the origins of food additives that have become increasingly important in our diet, as a check of the labels on many kinds of packaged foods will show. Housewives with well-stocked spice shelves will want to match their varieties against the more than 40 spices on exhibit. While examining the spices and their origins, see if you can point out the orchid without reading the label. Notice, too, the attractive way boards from old packing cases have been used in the background.

Cases showing the production of tea and coffee, with a miniature replica of a tea plantation, are nearing completion. There is also an exhibit on legumes, without which civilization might not have been possible; and a nearly completed exhibit on natural rubber, upon which our wheeled civilization depends.

Toward one end of the hall are newly finished models of well known vegetables. (Upstairs on the third floor, Members will have an opportunity to see how these marvelously realistic plant models are made.) Before leaving the hall, walk around once more just to look at the murals. These depict man's concern with plants from prehistoric times to but a short while ago.

In keeping with the botanical theme of Members' Night, Dr. Louis O. Williams, Chief Curator of Botany, who has spent a "life-time" in the tropics, will give several short lectures during the evening on the origins and romance of useful plants. The lecture room adjoins the botany hall on the second floor. In addition to the lectures, movies of botanical subjects will also be shown.

On the opposite side of the second floor, in the Hall of Fossil Plants and Invertebrates (Hall 37), a special exhibit of paintings will depict the beginnings of life in ancient seas, through the Age of Reptiles, the evolution of mammals, and the coming of man. The paintings were created for the *1965 World Book Year Book*, to illustrate the article on "Out of the Sea: The Life Story of a Continent." The copy was written by Dr. Eugene S. Richardson, Jr., the Museum's Curator of Fossil Invertebrates. Reprints of this handsome and informative article will be available in the hall for Members and their guests.

Moving on to the third floor, Members will want to view the new conservation laboratory in the Department of Anthropology. First of its kind in the Midwest, the laboratory contains the latest equipment for preserving archaeological and ethnological specimens, such as ancient bronzes and wooden sculpture, clothing, household goods, or weapons, Here in the laboratory, artifacts are examined by X-ray, microscope, or chemical analysis; washed or cleaned by chemical or electro-

(*Continued on page 8*)

Paula R. Nelson

australian expedition discovers landmark fossil site

Fossil hunting at these sites proved disappointing.

Above: a limestone quarry. Right: a coal bed outcrop.

Cover: a site where earlier collectors had found a nearly complete skeleton of an Oligocene marsupial.

ANNOUNCEMENT of an expedition to Australia always quickens our interest. Scattered pictures spring to mind: aborigines running toward a rain cloud; archaic lungfish that come to the water's surface to breathe; flightless birds; mammals that lay eggs; and above all the ubiquitous marsupials, mammals that nurture their young in external pouches. Which aspect is to be explored? It hardly matters. In every field of exploration—paleontology, botany, zoology, or ethnology—the Australian continent, free since the Cretaceous to develop its own distinctive modes of life—beckons us toward the unusual, the unique, the unknown.

It is from a 12-months' paleontological expedition "down under" that William Turnbull, Associate Curator of Fossil Mammals, has recently returned. With him, as co-director of the expedition, was Ernest L. Lundelius, Jr., Associate Professor of Geology at the University of Texas. Technical

Above: the Grange Burn, where the expedition uncovered a landmark fossil deposit. (Note basaltic rocks overlying the fossil soil.) Right: Bill Turnbull and son dig out the site.

assistance in the field research was provided by the directors' wives, Mrs. Priscilla Turnbull and Mrs. Judith Lundelius—both trained geologists.

The expedition set out to find evidence that would illuminate the obscure origin and evolution of Australia's ancestral marsupials. During the Mesozoic (see geologic table on page 6), the pouched mammals, perhaps under pressure from their more successful relatives, the placentals, had pushed into the outermost regions of the southern hemisphere. One of these regions—Australia—was separated from the other land masses of the world in the Cretaceous. The con-

tinent became a sanctuary, where the old marsupial line, free from placental competition, could experience a new resurgence. Marsupials spread everywhere over Australia, evolving an abundance of species adapted to every possible environment (desert or forest, burrow or tree top) and diet (witness koalas that subsist solely on eucalyptus leaves).

This adaptive radiation, which must have taken place during the Tertiary period, unfortunately left little trace. The fossil record of marsupial history is, as Turnbull puts it, "pitifully scanty." Moreover, no dates are known for the few remains of Tertiary mammals that have been found in Australia. The difficulty is that the terrestrial strata of Australia have never been correlated with other land or marine rock sequences for which dates are known. The Museum expedition hoped, first of all, to discover one or more deposits of Tertiary fossils that would help fill in the record of marsupial evolution. Secondly, the paleontologists wanted to find evidence that would make it possible to date Australian fossils more precisely.

The great risk was that they might fail to locate any Tertiary fossils at all. To increase the odds in their favor, Turnbull and Lundelius would need to identify and explore the most promising geologic formations.

THE Australian continent contains some of the earth's oldest rocks. Across the western two-thirds of its surface stretches the archaic pre-Cambrian shield. Ranging the eastern margin, from the northern shore to Tasmania, are highlands uplifted mainly in the Mesozoic. The most extensive sequences of Tertiary formations lie along the southern coast and in Tasmania. Here, promising localities would be outcrops of coal beds and freshwater limestones. Marine sediments found near the shore might also contain fossils of mammals whose bodies had been washed by ancient streams to the sea. Still another possibility would be the fossil soils that had been protected from leaching by overlying basalts laid down during the volcanic upheavals of the Tertiary. The great advantage of all these coast-line formations was that they might be correlated by their interfingerings with marine rock sequences whose dating is known.

In Melbourne, therefore, the expedition members set up their home base. Here the National Museum of Victoria acted as their host and cooperated in every way with their research. From this base, the expeditionary party set up a series of field camps equipped for fossil collecting and processing. Collecting is a matter of the paleontologist calling upon all his knowledge and experience to identify likely sites; then chipping out, digging up, or simply hauling away the rocks, soils, and sediments in which fossils might be buried. Processing means separating the fossil specimens from these matrices. This was done by wet-sieving—back-breaking work, in which sediments are washed and sifted through several grades of mesh screens that are gently agitated while partially submerged in tanks of water. Back at the Melbourne base, Monash University generously made space available for this task.

Processing specimens at a field camp (left). Shown below, left to right: handling bulk samples of matrix preparatory to wet-sieving; wet-sieving; drying the residues so that they may be examined for fossils.

Wet-sieving produces residues which must be dried and then painstakingly picked over. Every bit of sediment is examined—often under a microscope. If the searchers find fossil remains, good; but weeks of effort may turn up nothing but mineral concentrates. Yet even these have their uses: analysis of the minerals, or in some cases of ancient pollens found, can provide insight into the environmental conditions of the past. Such knowledge helps other paleontologists identify promising sites for future prospecting. (*over*)

PRE-CAMBRIAN	PALEOZOIC	MESOZOIC			CENOZOIC					
					TERTIARY					QUATERNARY
600 million to more than 4 billion years ago		TRIASSIC	JURASSIC	CRETACEOUS	PALEOCENE	EOCENE	OLIGOCENE	MIOCENE	PLIOCENE	PLEISTOCENE
	230–600 million years ago	230–181 million years ago	181–135 million years ago	135–65 million years ago	65–55 million years ago	55–38 million years ago	38–26 million years ago	26–12 million years ago	12–1 million years ago	1 million years ago to the present

When fossils are found (most commonly teeth) the yield per volume of residual sediments must be assessed. Add to this the paleontologist's general knowledge of how rarely fossils occur in the beds being sampled, and it is possible to estimate the volume of original matrix which must be taken to produce an adequate sampling of the fauna.

Through months of such work, at dozens of localities, the paleontologists persisted. There were no dramatic finds. In the coal bed outcrops, not a sign of bone turned up. However, the expedition did keep samples of coal bed concentrates for future analysis. Though Turnbull and Lundelius searched outcrops of freshwater limestones where workers of an earlier generation had found fossil deposits, there were no new finds. Many of these outcrops, they learned, had been quarried out for agricultural lime. Turnbull and Lundelius arranged with the National Museum of Victoria, the University of Melbourne, and the Victoria Mines Department to borrow the specimens found decades before, so that they could be studied at Chicago Natural History Museum and eventually be made known to science.

The near-shore collecting, on which the expedition had laid high hopes, proved especially disappointing. Eighty years before, a nearly complete skeleton of *Wynyardia*, an opossum-like Oligocene marsupial, had been discovered in a marine formation; and at another shore-line locality a Miocene faunal deposit had been unearthed. But the Museum party was able to uncover only a few fossil fragments from marine conglomerates. And by wet-sieving the beach sands, they got a single half of what is "probably" a marsupial tooth.

YET just such a fragment now opened up a whole new avenue of discovery. Some eleven years before, Mr. E. Gill, of the National Museum of Victoria, had found a single mammalian tooth in a fossil soil outcrop on the Grange Burn near Hamilton in western Victoria. The expedition members decided to follow up this slender clue.

Here, they struck pay dirt. Almost immediately, mammalian teeth turned up in material taken from the top layers of the Grange Burn outcrops. The party set to work, digging out and wet-sieving nearly three tons of fossil soil. This yielded some 500 pounds of concentrate. Though only a small portion of the residues could be examined during the next few weeks, more than 30 teeth, or fragments of teeth, representing six species of early marsupials, were found. This was a faunal deposit of immense value.

But were the specimens from the Tertiary, the crucial period for marsupial adaptive radiation? The stratigraphic evidence seemed clear, but other workers in Australia had initially judged their finds to be Tertiary only to recognize, on further analysis, that they were no older than Pleistocene. Dr. Ian MacDougall, of the department of geophysics at the Australian National University at Canberra, offered to run a potassium-argon test on a sample of the basalt overlying the fossil soil. His test showed the basalt to be 4.35 million years old. The Grange Burn fossil marsupials were firmly Tertiary.

In a report to the National Science Foundation, which had helped to support the expedition's work, Turnbull and Lundelius summed up the significance of the radiometric dating of the Grange Burn material:

> "It provides: (1) a check on the stratigraphic age; (2) a firm tie to the world-wide chronology; (3) the opportunity for better age-determinations of other terrestrial faunas in Australia; and (4) the first positively dated pre-Pleistocene fauna for that continent. This unquestionably is the most important accomplishment of the expedition."

BEFORE leaving Australia, the expedition rounded out its work by investigating several more recent faunal localities, including a classic area for Australian paleontology, the Wellington Caves of New South Wales.

This site is one of the best-known Pleistocene marsupial deposits on the continent. Large collections have been made by a number of scientific institutions, but the internal stratigraphy of the cave deposits has never been studied. Many earlier workers reported that stratigraphic levels simply could not be made out, and thus the possibilities of reconstructing the fossil history were severely limited.

The Museum expedition worked intensively for a week in the Wellington Caves. At the end of this period, Turnbull reported: "We believe that we have enough evidence to show that stratigraphy does exist with the deposits and can be interpreted. If we are right, the best thing we can do here is to try to document this . . ." The paleontologists mapped and photographed the caves and dug copious samples from each of the various strata they could discern. Here in the Museum, they will compare materials from each level to see if they hold evidence of faunal changes. "If future study supports our theories," Turnbull adds, "we will have shed new light on marsupial development in the Pleistocene, and greatly enhanced the value of earlier collections.

A scientific expedition—however carefully its goals are chosen, its methods refined—is always a risk venture. "We knew," Turnbull says, "that our chances of succeeding were even slimmer than most, since a century of searching before us had turned up such a meager fossil record. There is particular satisfaction, therefore, in reporting that some of our Australian expedition's most important objectives have been achieved." ■

* EXPEDITIONS 1965

MUSEUM expeditions in 1965 will again carry scientific research into many areas of the world. Highlights of this year's schedule are expeditions to Afghanistan and Guam.

Mr. and Mrs. William S. Street of Seattle, who led a highly successful expedition to Iran for the Museum three years ago, are now planning to go to Afghanistan in June. There they will collect specimens for a faunal study of Afghanistan's mammals. Since no such study has ever been undertaken, the expedition expects to solve many problems as to just what species do occur in that remote and beautiful country. Mr. Street's personal goal is to resolve, if possible, the disagreement as to whether there are more than one species of mountain sheep whose ranges come together in Afghanistan.

Accompanying the Streets will be two graduate students in mammalogy, selected from applicants in all parts of the country. Appointed by the Museum as Expedition Fellows are Jerry Hassinger of the University of California at Davis, and Hans Neuhauser of the University of Georgia.

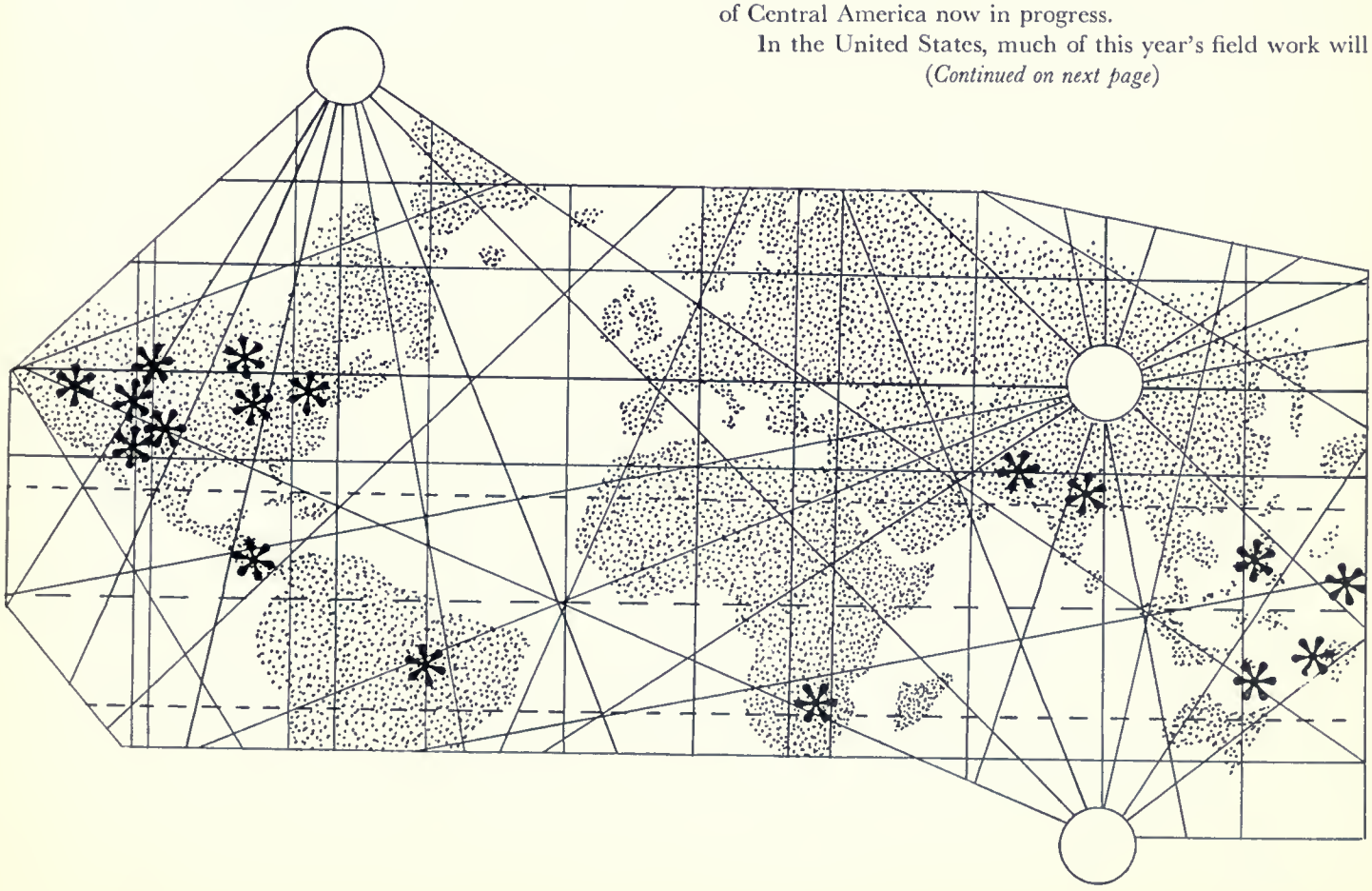
Mr. and Mrs. Street have been appointed to the honorary staff of the Museum as Field Associates, in recognition of their continuing contributions to science through expeditionary work.

Also in June, Dr. Fred M. Reinman, Assistant Curator of Oceanic Archaeology and Ethnology, will leave for a year of research on Guam in the Marianas Islands. Aided by a grant from the National Science Foundation, Rienman will conduct archaeological surveys and excavations to learn more of Guam's prehistoric people. He is especially interested in studying their exploitation of the sea as a food source.

Dr. Louis O. Williams, Mrs. Williams, and Mrs. Dorothy Gibson, Custodian of the Herbarium, have just returned from a two-months' field trip into Central America. They were accompanied during part of the trip by Chester Laskowski, a graduate student from the University of Michigan and by Professor Antonio Molina of Escuela Agricola Panamericana in Honduras. Field work was done in Guatemala, Nicaragua, and Costa Rica. Exploratory trips were made into two previously unvisited rain forest areas in Costa Rica, one on the Atlantic, the other on the Pacific slope near the Panamanian border. The specimens and information gathered are basic to floristic and systematic studies of the plants of Central America now in progress.

In the United States, much of this year's field work will

(*Continued on next page*)



be carried out in the western half of the country. Dr. Paul S. Martin, Curator Emeritus of Anthropology, will return to eastern Arizona, site of his investigations into the culture and history of the people living in that region from 5000 B.C. to A.D. 1400.

Dr. Rupert L. Wenzel, Curator of Insects, will make a short field trip into the Southwest to collect parasites of bats, especially flies of the family Streblidae. He hopes to obtain additional specimens of some recently discovered, undescribed species for a paper he is preparing on Streblidae of North America.

Extending his paleoclimatic studies into South Dakota and Montana, Dr. John Clark, Associate Curator of Sedimentary Petrology, will continue his search for ancient volcanic ash deposits, sandstones, and fossil animals which will help to interpret the geography and climate of North America 30 million years ago.

Dr. Robert H. Denison, Curator of Fossil Fishes, will revisit the Cañon City, Colorado, area seeking remains of the oldest known vertebrates. These rare fossils occur in 450-million-year-old sandstones. While small fragments of their armor have been discovered, Dr. Denison hopes to find better material that will give some clues to the appearance of these primitive, fish-like vertebrates.

The Big Horn Mountains of Wyoming will be the site of field work by Dr. Patricio Ponce de Leon, Assistant Curator of the Cryptogamic Herbarium, and Mr. Robert Stolze of the Department of Botany. In Wyoming, they will gather plants from this relatively uncollected area for the Museum's herbarium as well as for exchange with other institutions.

Dr. Edward J. Olson, Curator of Minerals, will be one of the few heading east. He will travel to New York State to collect spinel crystals for exhibit and exchange purposes.

Two of the Museum's staff planning field trips in the Midwest during 1965 are Mr. George I. Quimby, Curator of North American Archaeology and Ethnology, and Dr. Eugene S. Richardson, Curator of Fossil Invertebrates. Mr. Quimby will again be exploring the Upper Great Lakes region for sites inhabited by Indian tribes from 1600 to 1760. Dr. Richardson will continue his search of strip mines in Illinois for fossils of the Pennsylvanian period.

In addition to the expeditions and field trips by Museum staff, field associates and collectors working in collaboration with the Museum will be gathering data and specimens in many parts of the world. Through them, Museum research will continue during the year in Nepal, the Philippines, South America, New Guinea, and on many islands of the South Pacific. ■

MEMBERS' NIGHT - MAY 7

lytic means; impregnated or coated with preservatives. In addition to demonstrations of these techniques, a selection of rare artifacts from Italy, Tibet, and other areas will be displayed, some shown "before" and others "after" being restored to their original beauty.

The Library and the Department of Geology have arranged a walk-through of the new Museum building addition, now in the midst of construction. This addition will provide new stack space and offices for the Library; new technical processing, classroom, and research laboratories for the Geology Department; and will house the famed Walker Collection of fossil invertebrates. The walk-through will give Members their first opportunity to see the new space and visualize its completed appearance. Curators will be on hand to guide visitors through the storage area, and we predict reactions of amazement at its tremendous size.

In other behind-the-scenes areas of the third floor, Members will see the genesis of the forthcoming Street expedition to Afghanistan (see page 7). Displays in various curatorial laboratories will also trace the geography of South American mammals, show the difference between certain whale species, and examine variation and convergence in birds.

On the ground floor, in the divisions of fishes and reptiles, curators will discuss specimens collected on recent expeditions to the Indian Ocean and Borneo. On the fourth floor, visitors may view research drawing of snail shells and anatomy, see five cases of a new exhibit-in-progress, and handle the magnificent furs and skins that are always a special delight of Members' Night.

The Museum's open house begins at 6:00 P.M. and ends at 10:00 P.M. Dinner will be served in the cafeteria until 8 o'clock; refreshments will also be available on the second floor and in Stanley Field Hall. Free shuttle bus service will operate from Jackson and State to the Museum's south door, starting at 6:00 P.M. The buses will run at approximately 15-minute intervals, following the regular shuttle bus (No. 149) route and making stops along Michigan Avenue at Jackson and at Balbo. The last bus leaves the Museum at 10:45 P.M. ■

Chicago Natural History Museum
Founded by Marshall Field, 1893
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Members are requested to inform the Museum promptly of changes of address.

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CHICAGO NATURAL HISTORY MUSEUM
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May 1965

Gallus Indicus cum panico cæruleo Indico.

Meta P. Howell, Librarian

The Museum Library in Transition

"All that mankind has done, thought, gained, or been, it is lying as in magic preservation in the pages of books."

CARLYLE

THE LIBRARY has been in existence since the early days of Chicago Natural History Museum. It comprises the general Library, the four departmental libraries (anthropology, botany, geology, and zoology) and the respective divisional libraries. The general and departmental libraries are on the Museum's third floor, in the four wings of the building; so also are the divisional libraries, with the exception of the fish and reptile divisional libraries on the ground floor, and the lower invertebrate library on the fourth floor.

The Museum Library is designed to support the research needs of the scientific staff by accumulating and maintaining literature that contributes to the effectiveness of their scientific investigations. Emphasis is placed on the acquisition of serial publications of scientific societies and research organizations because they contain the original research reports which are of first interest to the scientist. The taxonomic approach to the sciences, in particular, necessitates the acquisition of entire runs of serial publications both old and new, in many languages, that contain the descriptions of names of new genera and species and embody the results

of systematic research. Serials, therefore, form the major part of the Library's holdings.

The ever-widening range of the Museum's scientific research has led automatically to expansion of the number of volumes in the Library. Moreover, the extensive exchange-of-publications program has also increased the size of the Library collection, especially during the past ten years when the volume of published research reports has greatly accelerated. This pattern of augmentation has established Chicago Natural History Museum Library as one of the nation's foremost sources of specialized information. There are now more than 165,000 volumes on the natural sciences in its combined collection. Currently we are the only museum library to be a United States Government Depository receiving selected publications under the Depository Library Program.

Due to the overlapping fields of interest of the John Crerar Library and this Museum's Library, and to avoid costly duplications in the two collections, an acquisition program is practised on a cooperative basis. Many titles, primarily descriptive natural history required for use with specimen study collections, must be together in one location. For this reason, John Crerar Library has transferred hundreds of serial publications on the natural sciences and selected titles within the scope of natural history to Chicago Natural History Museum Library. The foresight of John Crerar Library in placing this material in a focal location has served the two-fold purpose of making it easily accessible to the curatorial staff and their colleagues for taxonomic research as well as to scholars and students in general.

Some of the Library's most valuable acquisitions have come as gifts and bequests. One of the most notable special collections given to the Library is the collection of Orientalia bequeathed to the Museum in 1934 by the late Dr. Berthold Laufer, former Chief Curator of Anthropology and well-known sinologist. The collection in content spans the entirety of East Asiatic history and culture—art and archeology, biography, geography, history, literature, philosophy and religion, science, and industry. The books are written in both Occidental and Oriental languages, and include 7,809 volumes in Chinese and Japanese. More than 250 Tibetan xylographs (books printed from woodblocks) are also contained in the collection. These fine woodblock editions date from the Ming (A.D. 1368–1644) and Ch'ing (A.D. 1644–1911).

The present East Asia Library stems from this nucleus collection. It is housed in a separate room and is a divisional library of the Department of Anthropology. The wide range and diversity of this collection is being augmented by acquisition of older publications and those currently published, thereby bringing this material up-to-date on the languages, peoples, and history of the Far East. As a result of Dr. Laufer's gift and further comprehensive acquisition, the East Asia Library enjoys the reputation of containing many rare, irreplaceable, and unique items.

The contribution made by the late Mr. Edward E. Ayer to the collection of ornithological works is of signal importance. Due to Mr. Ayer's great interest in natural history, he took an active part in founding the Field Museum, now Chicago Natural History Museum. After the organization of the Museum, he presented to it his rare and priceless library of ornithological works. Many of the volumes are of folio size, richly bound, and illustrated with magnificent hand-colored plates of both birds and mammals. The original collection has been augmented with hundreds of important acquisitions, including long and complete runs of the most outstanding serial publications in this subject field.

A unique and most welcome gift came to the Library in 1948 through the generosity of Miss Thora M. Riley and Mrs. Emilie Conzelman Riley, the widow of the well-known

(*Continued on page 7*)

Opposite: Li Shih, *a book by Hung Kua (A.D. 1117–84), with this edition published in 1871. It contains reproductions of rubbings of inscribed and decorated tombstones dating from the Han Dynasty (207 B.C.–A.D. 220) (East Asia Library).*

Right: Color plate of the koala (Phascolarctos cinereus), from The Mammals of Australia *by John Gould (1804–1881), published in London in 1863 (Ayer Collection). The original of this photograph is life-size and exquisitely hand colored.*

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

Exhibits

MAY 17 marks the opening of the Museum's annual exhibition of art work by the Junior School of the Art Institute. The more than 60 paintings, drawings, and prints by Chicagoland art students will be on display in Hall 9 through June 13.

From exhibit of children's art

All the pictures in the exhibition are interpretations of various Museum exhibits. The young artists, who range in age from 6 to 16 years, make regular class visits to the Museum to study the many patterns, forms, and shapes found in the Museum's exhibits on nature and man.

THE 15TH Annual Amateur Handcrafted Gem and Jewelry Competitive Exhibition opens June 1 in Stanley Field Hall. All entries are prize-winners in the Chicago Park District's 1965 amateur lapidary competition.

Remember . . .

Members' Night, May 7

Members Invited to Hear Talk on Expedition

MEMBERS are invited to hear Loren Woods, Curator of Fishes, recount highlights of the recent International Indian Ocean Expedition. Woods spent six months on this scientific venture, which was sponsored jointly by UNESCO and the United States Program in Biology. He will present the illustrated talk to the Winnetka Chapter of the Izaak Walton League on May 25 at 7:45 P.M. at the Winnetka Community House, 620 Lincoln Street, Winnetka.

Staff Activities

IN COOPERATION with the National Science Foundation, the Museum will offer a ten-weeks' summer course in theoretical and practical archaeology at the Museum's field station in Vernon, Arizona. The course will be open to eight male undergraduate students from colleges and universities, who will be chosen to participate on the basis of their aptitude, scholarly achievement, and anthropological interest. The program is under the direction of Dr. Paul S. Martin of the Department of Anthropology. He will be assisted by James N. Hill and John M. Fritz.

A TWO-YEAR study of the classification and distribution of about 1,000 species of land snails inhabiting the Southern Hemisphere has begun under the direction of Dr. Alan Solem, Curator of Lower Invertebrates. His project is being aided by a $20,500 grant to the Museum from the National Science Foundation. Late this year, Dr. Solem and Mr. Laurie Price, of Kaitaia, New Zealand, will travel to Samoa and Tonga to collect specimens of land snails for their research. ■

Museum Pan Am

THE 75TH anniversary of the founding of the Pan American Congress, forerunner of the present Organization of American States, was celebrated on Pan American Day, April 14, at a tea held at the Museum in cooperation with the Pan American Council of Chicago.

Because of its long association with Latin America, the Museum was especially pleased to co-sponsor this event. Since its founding in 1893, the Museum has worked with scientists, scholars, and institutions south of the border to enlarge our knowledge of the land, the history, and the culture of the Americas. More than 240 Museum-published research reports have disseminated this knowledge throughout the world.

On display at the Pan American Tea was the "Bolivar" head, a recent gift of Mrs. A. W. F. Fuller of London. Here it is viewed by Mr. Joseph Redding, President of the Pan American Council, Col. John A. Reilly, Director of Special Events for the City of Chicago, Museum Director E. Leland Webber, and Dr. Donald Collier, Chief Curator of Anthropology.
In 1826, General Simon Bolivar, hero of the war for independence from Spain, presented the head to the British Consul General in Lima. The figure was made in central Peru during the Spanish Colonial period of the late 16th Century.

Dr. Rupert L. Wenzel, Curator of Insects, explains a display on his research in Latin America to Miss Judith Pelzmann, Executive Vice President of the Pan American Council. Dr. Wenzel is preparing for publication the first comprehensive treatise on the fleas, mites, and ticks of Panama. The volume is an indispensable aid to knowledge of many disease-carrying parasites.

:elebrates
ican Day

During 150 expeditions to Central and South America, the Museum amassed collections vital to the study of Latin America's plants and animals; its agriculture, minerals, and volcanoes; its contemporary Indian tribes, and the vanished civilizations that flourished before Columbus. These collections now rival or surpass those of any other institution in the world. Representative samples are displayed in the Museum's exhibition halls; reserved portions are used in research by scientists and scholars throughout the Americas and abroad.

The Museum's present roster of researchers in Latin America includes Dr. Louis O. Williams, botanist; Dr. Donald Collier, Aztec and Inca specialist; Mr. Emmet R. Blake, ornithologist; Mr. Philip Hershkovitz, mammalogist; Dr. Alan Solem, malacologist; and Dr. Rupert L. Wenzel, entomologist.

In reviewing their work, and the Museum's 72 years of cooperation in Latin America, Museum Director E. Leland Webber stated:

"The results of the scientific work we have undertaken in collaboration with our Latin-American colleagues can be easily assessed. The intangibles—which have developed out of a long history of good will and mutual endeavor among institutions and individuals—though less readily measured, certainly stand today as of equal significance." ■

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THE BULLETIN

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MANAGING EDITOR

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Members are requested to inform the Museum promptly of changes of address.

Only the hardest rocks, like these boulders of quartzite in Pigeon Creek, Tennessee, are naturally exposed. Mudstones like the one on the opposite page, are ordinarily hidden beneath the forest plants and soil.

John Clark, Curator
Sedimentary Petrology

Lucky Accidents

THE great majority of our Museum's collections are made systematically, as parts of research projects carefully planned by our curators. Occasionally, however, we find something of importance accidentally, while we are otherwise engaged—rather like searching a lawn for fourleaf clovers and finding a ten-dollar bill. Two such happy accidents which occurred recently have brought fine additions to our geological collections.

The first came last October, when Mrs. Clark and I were on vacation in the Great Smoky Mountains of Tennessee. Since my particular research concerns stream-deposited rocks about 30 million years old, this trip was obviously *not* to be a busman's holiday: the rocks in the Smokies are more than 600 million years old, marine in origin, and very poorly exposed. I had no particular interest in them. We planned to spend our days photographing autumn scenery, studying trees, and bird-watching.

However, the road cuts along the parkway near Gatlinburg had recently suffered four major slumps. Jagged gray blocks of rock lay in jumbled heaps where entire hillsides had slid over the road. Naturally I stopped to look at them, while Mrs. Clark stalked a towhee with her binoculars.

The first rock I inspected showed that these were not the usual slates and quartzites at all. Rather, these were rocks that had once been soft muds deposited in deep water, probably in the sloping trough of a very ancient sea. The plastic muds had been broken, folded, and squeezed into all manner of weird structures as they slumped down into the lower parts of the irregular trough. The muds had compacted just enough to preserve the identity of individual layers, before each mass slipped and moved. After movement and deep burial, mountain-building pressures had hardened them into solid rock without altering them enough to destroy the original structures (see Photograph II).

Very recently, errors in construction of this parkway had triggered slumps of the solid rock, which tore away the thick mantle of weathered soil and revealed the ancient record fresh for inspection. Three special events—a particular environment of origin, just the right amount of later alteration, and an engineering accident—had to happen, through 600 million years of time, in order to produce these rocks and bring them to the attention of one geologist who wasn't looking for them.

Muds deposited in marine troughs are not rare; in fact, some are forming today. However, the great majority have been so metamorphosed that their original structures have been destroyed. More recently-formed sediments are so soft that they can be collected and studied only with great difficulty. These were perfectly preserved and easily available: a really lucky accident.

I brought a few samples back to the Museum, and a month later Kenneth Kietzke of our Department and I took the Museum truck back to the Smokies. The National Park Service willingly granted us permission to collect. In two days we hammered out 147 specimens, totaling about one and a half tons, which gave us an excellent representation of all the major geologic structures present. Our Museum previously had nothing like this collection; few, if any, museums in America do.

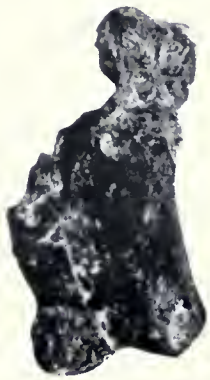
OUR SECOND lucky accident came on the return trip. Ken and I had decided that, since our Museum had never done systematic collecting in Tennessee, we would stop at every promising outcrop on the return trip and take samples of the invertebrate fossils. These grab-sample collections might serve as a geologic road-guide for future work. At our sixth stop we found richly fossiliferous rock, with a profusion of brachiopods, crinoids, bryozoans, and other interesting but common invertebrates. Suddenly we noticed

something else—a tiny shark tooth. Although these, too, are not uncommon in rocks of Mississippian age (about 330 million years old), they prompted us to take a closer look.

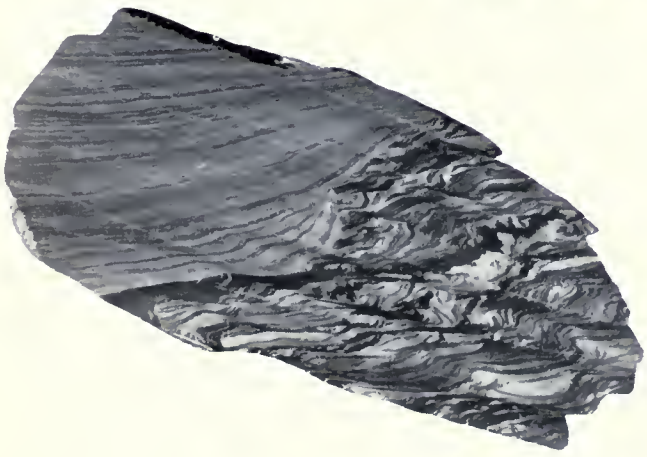
Then we made our really lucky discovery: a small black bone! It couldn't be shark, because they don't have actual bones, and it didn't look right for fish bone. Since Ken and I are not specialists in the other vertebrates of that extremely ancient age, we simply picked up every little slab that showed even a chip of bone, packed all of them carefully, and brought them home.

The original find has now been removed from the matrix and identified by our colleagues in the Geology Department. It is, without doubt, part of the skull of a small, very primitive amphibian (see Photograph I). This is not quite the oldest known amphibian, but it is almost so. Amphibian bones of Mississippian age are very rare, and have been found in very few places in America; moreover, until now our Museum has had none of them.

So a bird-watching vacation produced a unique collection of sedimentary structures, and a routine, road-log invertebrate collection turned up a rare Mississippian amphibian. Accidents like these help to build our Museum, to spice our lives, and to develop in us a certain humility. Every time we find something we didn't expect, we wonder how often we may have overlooked something else equally important. We have no way of knowing. ■



I. Bone from the ear region of a very primitive Mississippian amphibian. The picture is several times enlarged; the animal would have looked something like a mud-puppy about 8 inches long.



II. This rock was once soft, plastic mud at the bottom of an ancient sea. Before the upper, gray part was deposited, nearby slumps crumpled and squeezed the black and white layers. Then the gray layers were deposited over the torn edges, and after that the whole mass was very little disturbed.

The Museum Library in Transition

(*Continued from page 3*)

American entomologist, Charles Valentine Riley. Charles Darwin, author of the *Origin of Species*, had an Illinois correspondent—the man who became the first state entomologist of Illinois, Benjamin D. Walsh. The gift consists of eighteen letters written by Mr. Darwin to Mr. Walsh, during the period from October 21, 1864 to April 3, 1869. The collection includes nine holograph letters and nine written by an amanuensis. All are signed "*Charles Darwin*," and all are enclosed in their original postmarked envelopes.

Among the Library's unique collections are the original paintings by the late Louis Agassiz Fuertes, made on the Field Museum-*Chicago Daily News* Abyssinian Expedition of 1926–27. These paintings represent the last work of this skilled and talented artist and ornithologist. They were purchased by Mr. C. Suydam Cutting after the artist's death, and presented to the Library by him. As a member of the expedition, which traversed a large part of Abyssinia (Ethiopia), Mr. Fuertes found opportunity for life studies of African birds that were varied and unusual. The collection of 108 paintings includes a few of mammals.

Although not strictly in the area of special collections, the divisional libraries house literature in specific fields. As an example, the Reptile and Amphibian Division Library contains the collection of thousands of reprints on herpetology bequeathed to the Museum Library by the late Dr. Karl Patterson Schmidt, former Chief Curator of Zoology. This is one of the finest, most complete, and important literature study collections on reptiles and amphibians ever assembled, and is invaluable in the research work in herpetology.

The Geology Library has also been the recipient of noteworthy gifts. Dr. George Frederick Kunz, who was a Patron and a Corporate Member of Chicago Natural History Museum, and internationally known as a mineralogist and gem expert, gave his famous collection of many hundred volumes to the Library. Another gift worthy of mention is the five-volume collection of photomicrographs of more than one hundred meteorites, presented to the Library by Mr. Stuart H. Perry. The photomicrographs were made during the course of Mr. Perry's studies on the metallography of meteoritic iron. These five volumes contain more than 1,400 photographs, each accompanied by Mr. Perry's valuable interpretation of the structure revealed. Only three such sets have been made and these have been distributed to the United States National Museum, the University of Michigan (where Mr. Perry conducted his studies), and this Museum.

As a consequence of the continuing growth of the Library, there have been many problems in the overcrowded stacks and cramped working quarters. To keep pace with changing conditions, to improve working areas, and to cope with an ever-rising work load, plans for re-organization of the Library were taken into active consideration more than two years

(*Please turn the page*)

ago. At that time, the Museum's Administrative Office directed the Librarian to prepare an estimate of current space needs and a projection for the next twenty years. Estimates were made from figures reflecting the growth of the Library in the past twenty years, and by considering the increase in publications which will result from new research programs throughout the world.

The decision to fill in the former lightwell in the northwest quadrant of the building at two levels, to provide space for expansion, was most encouraging. The third floor level was assigned to the Library for stack and office space, and when the Museum received a grant from the National Science Foundation, construction began.

The new addition to the Library, now nearing completion, nearly doubles its present 96,000 cubic feet of space. The greater portion of the addition will be filled with double-faced, free-standing, light gray steel book stacks with adjustable shelves. A suspended acoustical ceiling in off-white enhances the brightness of the new stack area. The side walls will be painted pale blue with white flecks; the end walls are insulated glass and aluminum to admit light. Vinyl asbestos tile will be used on the floor. Good lighting is assured with the installation of continuous fluorescent fixtures along the length of the stack area.

In addition to stack space, the new area will provide office space for the Librarian, the Secretary, and the Serials Librarian; a Receiving Room for all incoming material; and a Browsing Room for the scientific staff. In the latter area the scientific staff may gather, undisturbed, to review and discuss the daily incoming periodicals and books. All rooms in the new addition are air conditioned.

A short corridor connects the new addition with the Reading or Reference section of the Library, which is the public service area and center for information, open to any reader interested in the natural sciences. Museum Members, teachers, students, scholars pursuing advanced studies, colleagues, and other researchers make full use of our resources and services, testifying to the importance of our Reference Division as a focal point in the Midwest for information on the natural sciences.

Improvements under way in the Reading Room include air conditioning, a more convenient arrangement of facilities, and a new look achieved by carrying out the same decorative scheme as that in the new addition. An added feature will be an illuminated exhibit case with adjustable glass shelves for the display of unique and special items in the Library collections.

The present Cataloging and Technical Processing Divisions are located in areas partially roofed in glass. The heat of the summer sun on the glass contributes to extremely uncomfortable working conditions, and to the general deterioration of books housed in those stack sections. In remodeling these areas, the books shelved in both rooms will be transferred to the new addition. The stacks now in the Cataloging Room will be dismantled and removed, which will give sufficient space for a more functional work area. A new suspended acoustical ceiling and attractive lighting fixtures will add to the functioning of this room.

Title page of Volume 2 of Ornithologiae, *by Ulisse Aldrovandi (1522–1605), published in Bologna in 1600 (Ayer Collection).*

Cover: Illustration from the above volume.

In the Technical Processing Division, badly needed space for the assembly and preparation of material to be bound, for minor repair jobs, and for the work of labeling and marking books, will be provided by the removal of the stacks now occupying almost the entire room. This section will include the new area designated for the Library's extensive map collection, which is presently housed in two separate locations. Another section of the Technical Processing Room will house the microfilm and microcard readers, and, eventually, photoduplication equipment.

The Library is now in the throes of construction of the new addition and remodeling of the other areas described. Completion of the work will result in vastly improved conditions in every section. It is recognized that the concept of a modern research library requires much looking and planning toward the future in order to fit the program of tomorrow as well as today. We hope that the needs of the Museum Library will be satisfied by the new construction for the next fifteen or twenty years. ■

CHICAGO NATURAL HISTORY MUSEUM

Bulletin

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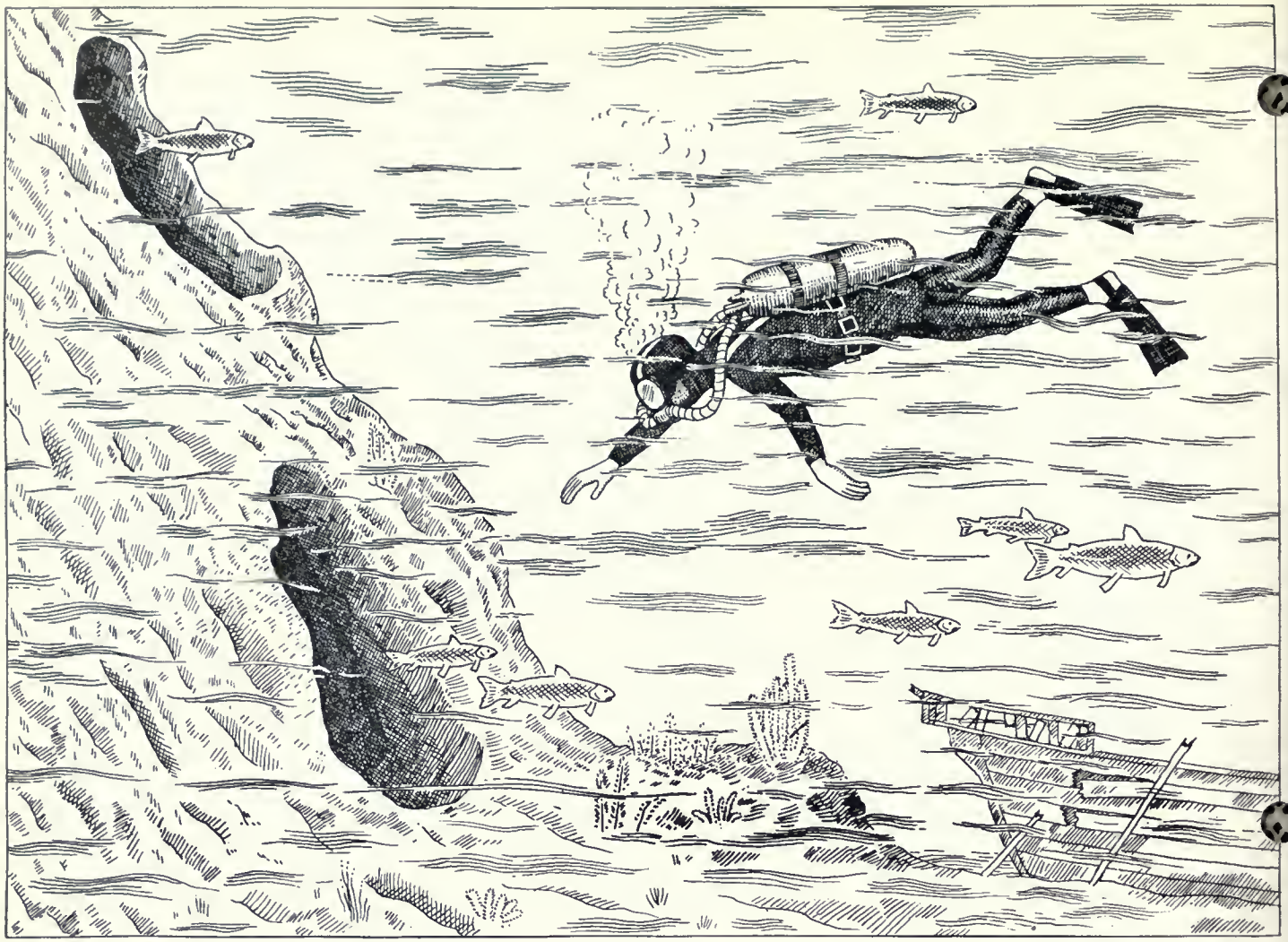

Drawing by Gustave Dahlstrom

Underwater Archaeology in Lake Michigan

George I. Quimby, Curator
North American Archaeology and Ethnology

UNDERWATER archaeology is the recovery, analysis, and interpretation of human and cultural remains of the past by archaeologists. It differs from above-water archaeology only in the special skills and techniques that are needed to work under water. So far, it seems to have been easier to teach diving to archaeologists than to make competent archaeologists out of divers. There is, however, a lack of archaeologists who are also divers, though no lack of divers who are not archaeologists. Some of the latter tend to become underwater pot hunters or treasure seekers who do as much damage to underwater archaeological sites as their land-bound counterparts do to above-water sites.

One acceptable solution to the problem is to have competent divers work in cooperation with and under the direction of a professional archaeologist. The ideal solution would be to have a number of archaeologists acquire sufficient training and skill in diving so that they could supervise and direct experienced divers in underwater excavation of archaeological sites. Conceivably, either combination could undertake important scientific work on the bottom of Lake Michigan. Although I have never been on the bottom of Lake Michigan, I am able to outline in tentative form the archaeology of this region from 8500 B.C. to A.D. 1700. This can be done by using the data of geology, ethnology, history, and archaeology to make inferences about the signs of human activity that should be found by divers on the lake bottom.

Lake Michigan is a large body of wa-

ter. It is 307 miles in length, has a maximum width of 118 miles, a maximum depth of 923 feet, and a surface area of 22,400 square miles.

In late glacial times, at about 8500 B.C., the retreating ice uncovered successively lower outlets on the east side of the Lake Huron basin, thereby considerably lowering the water levels of what is now Lake Huron and Lake Michigan. Between 8500 B.C. and about 7500 B.C. the water level in the Lake Huron basin was lowered to a plane 390 feet below the modern lake level, and the water in the Lake Michigan basin dropped to a point 350 feet beneath the present level. This low-water stage is called Chippewa in the Lake Michigan basin and Stanley in the Lake Huron basin.

The duration of the Chippewa–Stanley stage is not now known, but postglacial uplift of the land and the rise of the North Bay outlet caused water levels to rise again in the Huron and Michigan basins, so that about 3000 B.C. the water levels were near or at their modern elevation of 580 feet. What is here important about this radiocarbon-dated geologic history of the lake basins is its meaning for paleo-geography and archaeology both above and under water.

Between 8500 B.C. and 3000 B.C. the Upper Great Lakes region, which includes the Lake Michigan basin, was inhabited by Indians who made their living by hunting, fishing, and food gathering. In the early part of this long span of time there were groups of late Paleo-Indians whose culture was of a kind I have elsewhere called Aqua-Plano. They lived by the lake shore on the mainland or on islands for a part of each year and used various forms of large lanceolate knives and spearheads of chipped flint characterized by rather straight parallel ripple flaking. These Indians occupied the region from about 8500 B.C. to perhaps 4500 B.C.

Their culture was succeeded by those of the various groups of Archaic Indians who were in the region from about 4500 B.C. to sometime after 1500 B.C. The Archaic Indians used various forms of notched or stemmed knives and spearheads of chipped flint as well as lanceolate and trianguloid forms. Some of the Archaic cultures were manifested by varieties of spearheads and knives made of native copper by cold hammering and annealing.

Sites of the Aqua-Plano tradition as well as many Archaic sites are associated with fossil beaches and strand lines, indicating that these peoples maintained settlements along the shores of the Upper Great Lakes. In the northern part of the region these sites, especially the earliest, are on fossil beaches and strand lines that were uplifted, in some places several hundred feet, by the post-glacial upwarping of the land. But in the Lake Michigan basin the same fossil beaches and strand lines may be as much as 350 feet beneath the present mean water level.

If the Aqua-Plano groups of Indians moved their shore-line settlements lakeward as the water levels fell, there should be sites in Lake Michigan all the way down from the present level to 350 feet beneath this level. By the same token, as water levels rose, first Aqua-Plano and then Archaic sites should exist from 350 feet beneath the surface to the present level. (Archaic sites are also associated with a late beach stage which was 25 feet above the modern water level.) So on the bottom of Lake Michigan there should be ancient Indian sites and artifacts dating between 8500 B.C. and about 3000 B.C.

Where might such sites be found?

In the northwestern part of the Lake Michigan basin in Door County, Wisconsin, and Delta County, Michigan, one can see wave-cut cliffs and sea caves in the limestone hills. Moreover, the lake bottom, which is also limestone, has a topography resembling that of the land. From soundings and observations of scuba divers I know that there are also cliffs and caves beneath the water. Because the above-water caves in this area were occupied by Archaic Indians, I would expect that the underwater caves, prior to their submergence, were also occupied by Archaic Indians who lived there at an earlier time, or by Paleo-Indians of the Aqua-Plano tradition. About 7500 B.C., what is now the bottom of northwestern Lake Michigan would have been an area of rocky shores backed by a limestone escarpment at least 350 feet high. There probably were spectacular waterfalls and there must have been numberless ledges, caves, and rock shelters suitable for occupancy by Indians.

South of this area, the bottom of Lake Michigan to a depth of 350 feet would have consisted of more or less rolling land that sloped toward the shore of Lake Chippewa and was covered with deciduous forests. Remnants of this forest have been found in Lake Michigan near Racine, Wisconsin. Underwater archaeological sites should be present in the fossil beach and strand lines that mark the former low-water stages in this area.

Underwater sites later than about 2500 B.C. should be lacking in the Lake Michigan basin because there have been no appreciable low-water stages since that time. It is possible that divers might encounter sunken dugout canoes that had become waterlogged, or they might find artifacts that had been eroded from shore-line sites and redeposited in deep waters. But, in general, the opportunities for underwater archaeological research on prehistoric Indian remains that are more recent than about 2500 B.C. seem to be meager.

With the advent of the Historic Period, which began shortly after A.D. 1600, the opportunities increase again. Artifacts have been recovered from historic sites and wrecks under the water. For instance, along the south shore of Lake Superior some historic sites are now under water or washed away because of the drowning of that shore caused by differential upwarping of the northern part of the Lake Superior basin. There are artifacts and washed-out sites under Lake Superior's waters in the vicinity of La Pointe and Long Island. In the rivers draining into Lake Superior, Lake Huron, and Lake Michigan there are the possibilities of recovering Historic Period artifacts lost in canoe wrecks. Notable recoveries of such items already have been made in Minnesota and Ontario.

In the Lake Michigan basin there probably are no Historic Period sites beneath the water, but there should be

(*Continued on page 8*)

Exhibit on Museum activities in Stanley Field Hall.

MUSEUM NEWS

From a member's point of view

ON THE evening of May 7, 2,556 Members, their families, and their guests, enjoyed a unique view of new developments in research and education at the Museum. The record crowd gave a major share of attention to the new Hall of Useful Plants, which displays the plants and products on which man's pleasures, economic welfare, and progress depend. Other centers of attraction during the Museum's annual open house were the Library addition and the new facilities for research and graduate education in geology, now at the mid-point in construction.

Dr. George Wells Beadle, President of the University of Chicago (center), tours the new geology facility with Museum Director E. Leland Webber (left) and Dr. Rainer Zangerl, Chief Curator of Geology (right).

In the Hall of Useful Plants a visitor examines an exhibit of rare botanical books published from 1552 to 1756. Below right: Dr. Louis O. Williams, Chief Curator of Botany (center) takes Members through the new Hall.

Cover from Exhibit of Children's Art

THIS MONTH'S COVER—a painting of giraffes, by Germaine Paul, aged 13, of Chicago—is typical of the children's art being shown at the Museum through June 13. The more than 60 art works in many media were made by students in the Junior School of the Art Institute. These young artists, who range in age from 6 to 16 years, visit the Museum regularly with their art classes to study the varied patterns and forms found in the Museum's exhibits on nature and man. Visitors to the art show are enjoying the youngsters' bright and imaginative impressions of Museum displays.

Lapidary Exhibit Continues

EXQUISITELY cut gems, jewelry of original design, collections of polished stones, and many decorative objects fashioned from rock materials are on display at the Museum through July 5, in the annual exhibition sponsored by the Chicago Lapidary Club.

Summer Hours

BEGINNING Saturday, June 26, the Museum will be open until 8 P.M. four evenings a week, on Wednesdays, Fridays, Saturdays, and Sundays. These are the nights of the Grant Park con-

certs. The Museum cafeteria will serve dinner until 7:30 P.M. On other days the Museum is open until 6 P.M. Summer hours will remain in effect through Labor Day (September 6).

Staff News

THEODORE HALKIN, Artist in the Department of Anthropology, was awarded the Logan prize of $1,500 for his entry in the 68th annual exhibition of artists of Chicago and vicinity held at the Art Institute. His prize-winning work is a sculpture entitled "Fountain No. 1."

For the Museum, Mr. Halkin designed the exhibition hall on "China in the Ch'ing Dynasty," which opened in January of 1964. He is currently working on the Tibetan hall, which has been closed to the public for complete redesigning and reinstallation.

AT the annual meeting of the Society for American Archaeology held recently in Urbana, Dr. Paul S. Martin, Chief Curator Emeritus in the Department of Anthropology, was installed as President. Other members of the Department who participated in the meetings were: Dr. Donald Collier, who chaired a session on South American archaeology; George I. Quimby, who was program chairman for the meetings and gave a report on a 17th century prehistoric site in Michigan; and Dr. Fred Reinman, who chaired a session on archaeological work in California and the Pacific islands.

New Summer Journey for Children

"MARSH DWELLERS" the Museum's new summer Journey for children, will be in effect during June, July and August.

The Journey acquaints youngsters with the many varieties of plants and animals found in swamps and marsh lands around the Chicago area.

By Journeying to selected exhibits within the Museum halls, children will learn to recognize many different marsh plants. One is the American lotus, whose submerged roots and buds provide food for beavers and muskrats. The arrowhead, another common marsh plant, has underwater corms or rootstocks that are gathered and stored by muskrats for food.

Marsh-dwelling animals are also featured on the Journey. Muskrats, for example, make their houses of mud and reeds that grow along the water's edge. The large bull frog, whose deep booming call is heard at night, also lives in wet lowlands. A marsh-dwelling reptile is the Massasauga, or swamp rattler—the only poisonous snake in the Chicago area.

Even fishes are included in the Journey, since some species, such as the northern pike, spawn in marshes around the edges of lakes. Other fish feed or seek shelter in the marshes.

Birds are probably the most conspicuous and beautiful marsh dwellers. The red-winged blackbird nests in reeds growing in the water. Herons are found on the edges of marshes, where they prey on fish, frogs, and other small aquatic animals. The least bittern is often present, but is shy and secretive, blending in with the reeds and grasses. Exhibits of these birds and their habitats are stopping-places on the new Journey.

In addition to identifying many marsh dwellers, Journeyers will learn about the values of marshes to wild life and to man. Animals get both food and cover from the marshes. Marsh plants provide birds with nesting materials. Because marshes hold and store water, they are important in flood control. Familiarity with marsh lands and the wild life they shelter adds another dimension to our enjoyment of the outdoors. ■

This muskrat exhibit is a stopping point on the summer journey.

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Founded by Marshall Field, 1893
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THE BULLETIN

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Members are requested to inform the Museum promptly of changes of address.

By C. Earle Smith, Jr.[1]

Garbage is Golden

In the Tehuacán valley of Mexico archaeologists have discovered the beginnings of agriculture in North America

RARELY WILL readers of the BULLETIN consider garbage to be golden. To archaeologists and botanists, however, garbage can prove to be even more valuable than gold. One such instance is illustrated by discoveries in the Tehuacán valley, in the southeastern corner of the state of Puebla, Mexico.

The Tehuacán valley is a large trough just inside the Sierra Madre Oriental which separates the states of Puebla and Vera Cruz. The other side of the valley is formed by the lower but very rugged masses of the Sierra de Zapotitlan. From the town of Tehuacán, which lies at an elevation of about 5,600 feet, the valley drops to about 2,000 feet where the major river drainage cuts through the mountains to the east.

The rainfall is rather low and markedly seasonal (the annual 15 inches at Tehuacán falls primarily from June through September), and the natural vegetation is thorn-scrub-cactus forest. During the summer rainy season the trees are clothed in full foliage and the shrubs often bear flowers and fruit. In marked contrast, few of the plants have leaves during the dry season; the landscape is largely shades of brown and tan.

Ever since the discovery of an evolutionary series of corn cobs at Bat Cave, New Mexico, archaeologists have been aware that the refuse of ancient people may yield evidence for the domestication of crops and the attendant social advance called civilization. Among the foremost searchers for archaeological plant remains is Richard S. MacNeish, Chairman of the Department of Anthropology at the University of Alberta, in Calgary. In the hope of tracing the stages in the domestication of corn, MacNeish excavated a series of dry caves in northern Mexico in the state of Tamaulipas. These excavations provided exciting evidence for the activities of local Indians from about 7000 B.C. to historical time, but did not reveal the hoped-for transition from wild to cultivated corn. MacNeish reasoned that the answer must lie further south in Mexico. Another excavation at Santa Marta Cave in Chiapas again yielded valuable data, but not the elusive transition. MacNeish's conclusion was that the correct area must lie between these northern and southern sites—but where?

A search of geological and geographical articles, weather records, and travel accounts finally led MacNeish to look at the area around southeastern Puebla. Here, geological formations promised caves and rock-shelters, the climate was dry, and several large springs furnished year-round water. Investigation proved that there were indeed caves in the Tehuacán valley. A school teacher, hearing of MacNeish's interest in caves with plant remains, directed him to the large rock-shelter that afterwards became known as Coxcatlán Cave. A test pit dug within this cave yielded corn cobs that were large near the surface but which became progressively smaller downward.

With his first test samples, MacNeish went to Paul C. Mangelsdorf, world authority on corn, and asked for his opinion. Mangelsdorf agreed that MacNeish appeared to have an evolutionary series for corn which might show the transition from wild to cultivated plants. In order to prove this, though, the stage must be carefully set. A full scale excavation of Coxcatlán Cave would provide basic information, but there might turn out to be only intermittent occupation represented at Coxcatlán. Other caves must also be excavated. Because not all of the people had lived in caves during the later history of the valley, village sites would have to be found and excavated. If the excavations furnished plant remains, pottery, tools, and ornaments in

[1] Formerly Associate Curator of Vascular Plants in the Museum's Department of Botany; now Botanist for the Crops Research Division, Agricultural Research Service, United States Department of Agriculture.

Exterior view of two Tehuacán valley caves from which plant remains were recovered

Excavating within the Coxcatlán cave (photograph courtesy of the Trustees of Phillips Academy)

the volume hoped for, no archaeologist working alone could do the complete job.

MacNeish then decided to approach the many specialists who would be needed to assist the archaeological work and aid in interpreting the finds. He also applied for funds to hire field help to make the excavations, sort the samples, and transport specialists to the area. The R. S. Peabody Foundation, of Andover, Massachusetts, agreed to act as sponsoring agent and home base. Thus the Tehuacán Archaeological-Botanical Project, with MacNeish as director, was born.

The National Science Foundation and the Rockefeller Foundation agreed to support the Project in a three-year program. As the work advanced, more and more people joined the group. Scientists mapped the geography and geology of the region and surveyed the irrigation systems. A laboratory was organized where textiles and pottery could be examined. Specialists studied the faunal remains and the human skeletal materials that were found. Others worked on the local ethnobotany as well as the ancient plants and pollens. I was asked to analyze the plant materials other than maize, beans, and squash.[2]

THE ARCHAEOLOGICAL record proved a most remarkable one. Altogether, five caves were excavated along with five open sites. No one cave or site furnished an unbroken record of artifacts (Coxcatlán Cave was the most complete record), but the combined record covers a time span from 10,000 B.C. to A.D. 1500. From the open site excavations, the recovered evidence is solely in the form of pottery, stone, and bone artifacts. The evidence from the protected caves is a remarkable assortment of durable artifacts mixed with discarded sandals, bits of string, torn rags, discarded nets, and—garbage! Over 50,000 individual pieces of plants were found in the cave deposits.

Perhaps as important as anything else that the artifacts disclosed is the fact that the Tehuacán valley people apparently were never forcibly invaded or displaced. Thus the archaeological record is a smooth one, showing the continuous development of one society over a long period of time. Concomitant with the development of material aspects, such as the arts of ceramics and weaving, the growth of agriculture from a gathering economy could be traced. Yet the valley people were not a self-contained group sealed off from the rest of Mexico; this is proved by the variations shown in their arts and also by the cultivated plants that were introduced into the valley agriculture.

Major finds include some of the earliest cloth known for North America. In a stratum dated about 5700 B.C., fragments of twined cloth were found in associated burials of two adults and a child. The condition of the remains suggests that a ceremonial burial had taken place: the Tehuacán people had developed social ideas involving deities for whom rituals were required.

Another of the important artifactual finds in the Tehuacán excavations is the earliest pottery known for North America. A number of pieces of crude pottery, belonging to strata dated at 2300 B.C. to 1500 B.C., were made with thick sides and rough exteriors. The shapes were the same as those of stone vessels used in earlier times. No claim can be made that the manufacture of ceramic vessels was invented in the area, but there is no doubt that these early vessels show no sophistication in the art of pottery making.

Perhaps the most important bits of evidence are provided by the plant materials. For the first time, modern man has seen the remains of wild corn. Paul C. Mangelsdorf has

[2]Chicago Natural History Museum has recently published two of Dr. Smith's technical reports on his work with the project. They are: "Agriculture, Tehuacán Valley," *Fieldiana: Botany*, Vol. 31, No. 3 (January 22, 1965); and "Flora, Tehuacán Valley," *Fieldiana: Botany*, Vol. 31, No. 4 (February 26, 1965).

Left: This straight pin, taken from the Tehuacán excavations, is dated about 100 B.C. It was made from a cactus spine and a strip of maguey fiber tied in a turks-head knot. Center: Fiber from the maguey plant was used to fashion this sandal found in the Tehuacán valley. It is about 15 centuries old. Right: Fruit, dating from A.D. 300, found in the Coxcatlán Cave.

confirmed that the earliest corn cobs, dated at about 5,200 B.C., are wild corn probably gathered from the nearby areas. From these earliest cobs, the Tehuacán excavations furnish series of cobs which detail the evolution of maize into several races that still grow in Mexico today. Although the Tehuacán maize is both wild and the earliest known, the area was not the only one in which maize was being domesticated. Other (and later) strains of maize found in the excavations, including some hybridized with the wild grass, *Tripsacum*, were probably imported from a nearby area of Mexico.

The earliest avocado seed known was found in one of the earliest levels of Coxcatlán Cave. It can be dated as of at least 8000 B.C. In later levels, avocado seeds become more numerous and show evolution of size and shape. Toward the upper part of the deposit, the seeds are more elongate and much larger. This is the first evolutionary series known for a fruit tree.

The two fragments of cotton boll discovered in a level dated 5700 B.C. are of interest for another reason. For many years, some geneticists and anthropologists have argued that American cotton is the product of hybridization between a wild American cotton and an Old World cotton carried across the Pacific by man. The Tehuacán cotton bolls prove that the American hybrid cottons were in existence before the time when there is any evidence to suggest that man crossed the Pacific in a latitude at which cotton could have survived the passage.

"Scotty" MacNeish's determination to find the evidence for the beginnings of agriculture in America and his effort to enlist the cooperation of scientists in many fields have been spectacularly rewarded. The work of the Tehuacán Archaeological-Botanical Project has firmly established the transition from gathering to agriculture, the evolution of maize and avocados, and the age of hybrid cotton. It has also created an awareness that Tehuacán is only a small part of the story. Many additional excavations are needed to fill in the details of the domestication of crop plants and the formation of villages and social institutions, before we will be able to trace the full history of man in America. ■

Underwater Archaeology

(*Continued from page 3*)

wrecks of freight canoes. And if La Salle's trading ship, the *Griffin*, sank in a September storm in 1679, as reported by Father Hennepin, then the wreckage most probably lies on the bottom of northern Lake Michigan. This would be the first shipwreck in Lake Michigan, and the only one prior to A.D. 1700.

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Afghanistan expedition gets under way

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CHICAGO NATURAL HISTORY MUSEUM

Museum News

COVER: At Navy Pier, one of two especially equipped travelalls (one donated by International Harvester) is loaded aboard a ship bound for Karachi (photograph by John Bayalis).

LEFT: Mr. Jerry Hassinger, expedition fellow (left), Mrs. Janice K. Street, Mr. William S. Street, and Dr. Joseph Curtis Moore, Curator of Mammals. During the past six months, Dr. Moore has been helping to plan the scientific aspects of the Afghanistan mammal survey.

Honor Expedition Leaders

LAST MONTH Museum Trustees and their guests attended a dinner at the Museum honoring Mr. and Mrs. William S. Street of Seattle, who are leaders of the Museum expedition to Afghanistan.

The Streets are former Chicagoans, Mr. Street having been general manager of Marshall Field and Co. from 1943 to 1946. He was president of Frederick and Nelson's department store in Seattle until his retirement in 1963.

The purpose of the expedition is to make the first complete survey ever undertaken of Afghanistan mammal species, and to bring back to the Museum for this study perhaps 2,000 sample specimens of the animals found.

Both Mr. and Mrs. Street are experienced hunters. Among the animals they hope to collect in Afghanistan are the snow leopard, the huge Marco Polo sheep, whose horns spiral out to nearly four feet across, the gazelle, the Asian black bear, and smaller game down through about 100 other species to the tiniest shrew.

This is the Streets' second major expedition for Chicago Natural History Museum. Exactly three years ago they launched a similarly highly mobile, seven-month expedition to Iran, bringing back 1,723 specimens, many of which had never been represented in museum collections in this country. Readers who recall the series of delightful letters written by the Streets from their camps in different parts of Iran and published in various issues of the *Bulletin* during 1962–63, will be interested to know that Douglas Lay, who was their expedition fellow, has studied those specimens and has submitted for publication by the Museum the resulting 400-page scientific report on the mammals of Iran.

The Streets left Chicago for Afghanistan on June 13. At Karachi, West Pakistan, they were joined by two expedition fellows for the 800-mile drive to Afghanistan up through the Khyber Pass.

The senior fellow, Mr. Jerry Hassinger, left his doctoral studies at the University of California in January to help purchase, pack, and ship the expedition's two travelalls and 5500 pounds of other gear. He also studied Asiatic mammals in the Museum, and planned the detailed itinerary that would enable the expedition to accomplish the greatest amount of scientific discovery. The other expedition fellow, Mr. Hans Neuhauser, left his graduate studies at the University of Georgia in June for three weeks of preparation at the Museum before flying out with Hassinger to join the Streets at Karachi.

Hassinger hopes to submit his study of the terrestrial mammals of Afghanistan as a dissertation for the doctorate degree, and Neuhauser expects to focus on the bats of Afghanistan and to utilize his study as a thesis for the masters degree. Both expect to submit their research to the Museum for publication.

When the main part of the expedition drives out of Karachi (about the same time this article appears), another section of it that has already left the American University of Beirut in Lebanon will be driving a Land Rover more than 2,000 miles to converge with the Streets upon Kabul. Dr. Robert Lewis, a professor at Beirut and the world's authority on Middle Eastern fleas, was invited to join the expedition as its medical entomologist. He will make a scientific survey of the fleas of the mammals of Afghanistan, a work that will have immediate medical importance because of the ability of fleas to transmit diseases to humans. Dr. Lewis' graduate student, Mr. Sana Isa Atallah of Jordan, accepted an appointment as the expedition's preparator, and accompanies him from Beirut.

It is an extraordinary new development in the mobility and planning of expeditions to undertake a complete survey of the mammal species of a whole country in one expedition. The Streets have already done this for Iran, however, and are now well prepared and manned to bring this off for Afghanistan.

JOSEPH CURTIS MOORE

(Museum News continues on page 7)

Our Geologic Age

Drawing by Tibor Perenyi

Edward J. Olsen
Curator, Mineralogy

Are we still living in the ice age, with another glacial period ahead? A review of recent evidence throws light on this question.

MOST PEOPLE find it difficult to imagine the enormous span of geologic time. To be told that the earth is five billion (5,000,000,000) years old, or that such-and-such a rock is "only" two hundred million years old (200,000,000) means almost nothing to us. The numbers are too large and too far out of proportion to the span of our own lives. The geologic column is a representation of the long road of geologic time, with signposts along the way marked with curious names like Jurassic, Permian, Silurian, Cambrian, Pre-Cambrian, etc. By and large, we tend to think of geologic time as something quite apart from our own lives. Most of us never stop to think that we ourselves live in a geologic epoch. We are first-hand observers of a tiny piece of the old earth's geologic history.

It is rather fascinating to consider this and to wonder in just what geologic age we are now living, and where we are heading in the immediate future. There is a considerable body of evidence from which we can draw definite conclusions. Let us begin by reviewing our immediate geologic past.

During the past 325,000 years, much of the northern hemisphere passed through a vast glacial period, which is called the Pleistocene Epoch. It consisted of seven periods of general climatic cooling, with four major and three minor southward thrusts of huge circumpolar ice sheets. In North America, for example, thick ice sheets pushed southward from the Canadian arctic and covered the northern portion of the United States down to the present Ohio River valley in the midwest, and not quite so far south out on the Great Plains. Each southward push was followed by a period of warming and melting, with decay of ice and its retreat northward; this is called a glacial interstage.

Although we can clearly map the areal extent of each of these glacial advances, we are not absolutely certain of the thicknesses of the great ice sheets. The best estimates suggest that they were probably 5,000 to 6,000 feet high at their centers, thinning to about 100 feet thick along the advancing edges. When such enormous volumes of water are frozen and piled up on the land, the

(*Continued on next page*)

volumes of the oceans naturally decrease, and mean sea level is lowered. During glacial interstages the increased melt water from the receding glaciers again raises the mean sea level. Thus sea level changes are good measures of glacial advances and retreats.

Along the seacoasts of continents and oceanic islands, waves pound away year after year and gradually cut benches into the rock. If sea level then rises or falls a new bench level is cut above or below the old one. In low latitudes, where living coral reefs occupy coast lines just below water level, the reefs themselves are often cut into a series of benches by changes in sea level. With the advent of the carbon-14 dating method, the ages of such reef benches can be determined, because the coral animals deposited their carbon-bearing reef material at the time of the bench-cutting wave action. Thus it is possible to relate past sea level changes with time.

Here it must be added that it is only possible to find ages for the last single period of sea level rise. This is because bench levels corresponding to more ancient sea level changes are destroyed by each younger cycle of wave action. Thus the carbon-14 "clock" is reset after each cycle of sea rise and fall.

F. J. SHEPARD (reference 4), a well-known oceanographer from the Scripps Institution of Oceanography, has compiled a group of carbon-14 dated sea level changes from different coasts around the world. The dates are determined on samples of rock, usually corals, collected from benches that are presently submerged, that are now at sea level, or that are above present sea level. In addition to Shepard, other oceanographers (references 1, 3, and 5) have reported dated sea levels. All these have been compiled together into Fig. 1.

Individual points, each representing a dated sea level, are shown in this figure. The points are slightly scattered, reflecting errors of analysis in the carbon-14 dating, as well as some samples where the rock was affected by chemical changes. Some scattering is also due to small, minor, short-term oscillations in sea level. Nevertheless, a smooth curve may be drawn between the points.

This curve presents some fascinating features. The lowest point determined is that of a wave-cut bench which is 290 feet below the present sea level, and is 17,000 years old. We have no older dates until we come to some levels which were 10 to 20 feet above present sea level around 35,000 to 40,000 years ago. It was mentioned before that only the last period of sea level rise can be dated. However, while this is generally true, an obvious exception is possible. If the sea ever stood *higher* than at present, and if sea level then fell, this higher level, no matter how old, would be preserved well above the pounding action of waves. Thus the 35,000 to 40,000 year old levels have been preserved, while wave action, during the period of descending levels, has destroyed all lower benches made between 35,000 years ago and the time when sea level started to rise again and make new ascending levels.

It may be concluded, therefore, that sometime between 35,000 years ago, when the sea was higher than at present, and 17,000 years ago, when it was 290 feet lower than at present, sea level reached a minimum. If we simply draw a smooth curve through the points we can obtain a rough idea how far the level dropped, and at what time. The "trough" in our curve is at about 310 feet below present level, about 18,000 years ago. This "trough" would then correspond to the last period of maximum glacial advance, when the most amount of water was frozen up on land.

Another interesting feature of this curve is its shape. From 18,000 years ago almost to the present, sea level generally rose with the melting away and retreat of the very last glacial advance. The rise was not, however, at a constant rate, as can be seen from the curve. Starting out around 18,000 years ago, the sea level began to rise at a rate of less than five inches every 100 years. The rate of rise reached its maximum around 10,000 years ago when it was about 35 inches every 100 years, or a rate of rise seven times faster than at its start. Since that time the rate has been steadily dropping, and for at least the last 2,000 years the rate has been zero. There are, of course, minor oscillations of short duration—100 to 300 years long—due to minor climatic fluctuations, but the overall effect is that the sea level has reached its peak.

Several oceanographers, in fact, argue that the rise reached its peak about 3,000 to 4,000 years ago, and sea level has actually started to fall again slightly. Bench levels that old have been found which lie 8 to 10 feet above the present level of the sea. For example, van Andel (reference 5) reports a bench level on the Brazilian coast which is 8½ feet above present sea level and is 3,660 years old. This level is not considered to be due to a minor fluctuation.

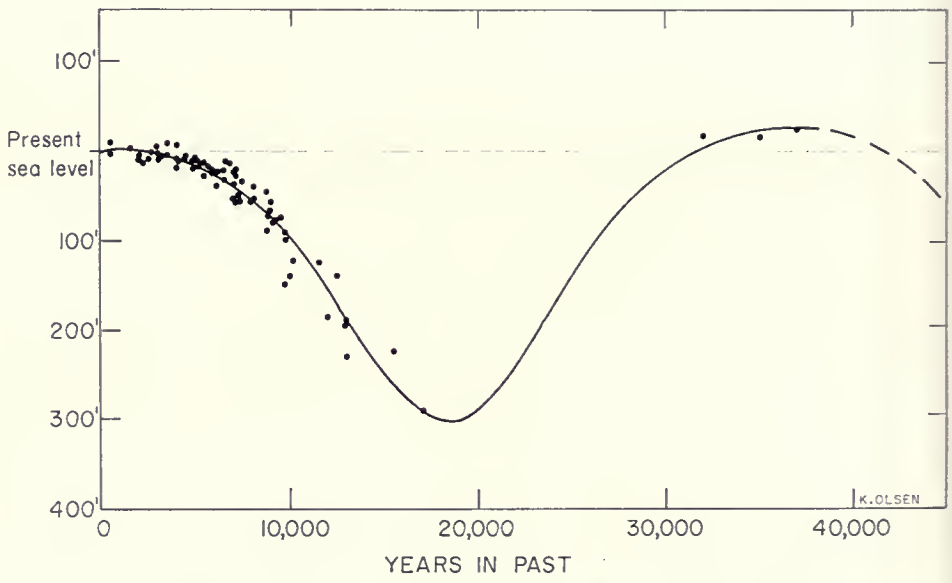

FIG. 1. Graph showing changes in mean sea level during past 50,000 years.

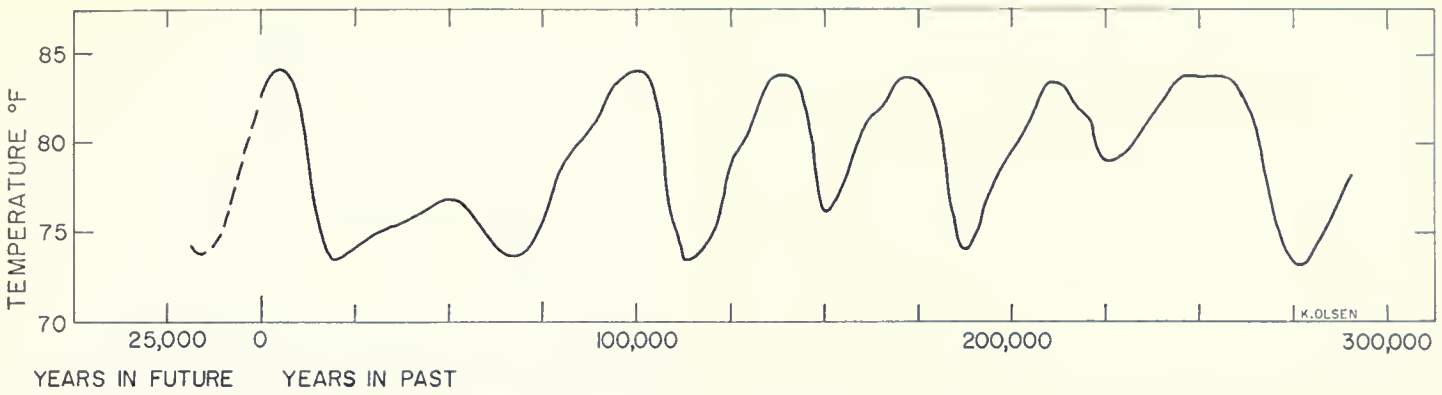

FIG. 2. Graph showing changes in oceanic surface water temperature during the Pleistocene Epoch (solid line), and projected into the future (dashed line). (Based on Emiliani, reference 2.)

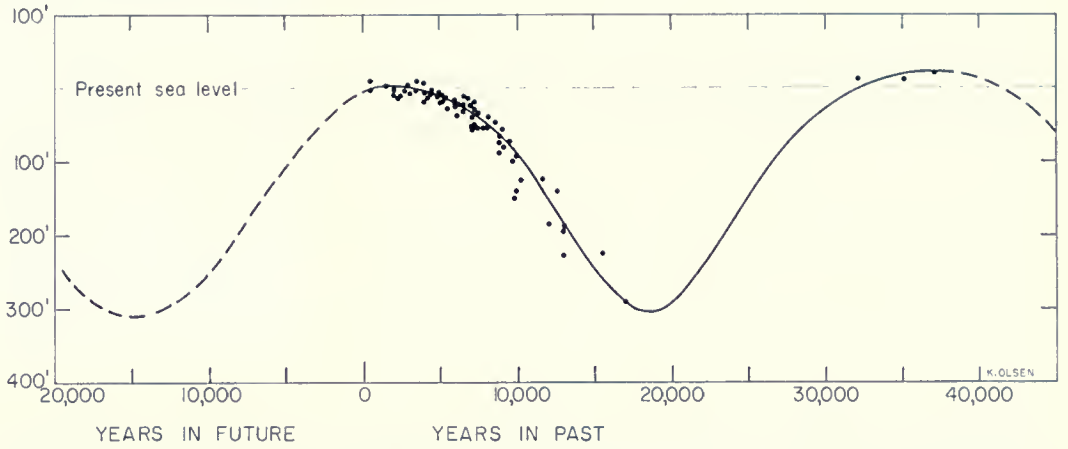

FIG. 3. Graph showing changes in mean sea level during the past 50,000 years and projected into the future.

Thus there are apparently two interpretations of the most recent data. The first says that sea level is now at its peak and its rate of rise is zero, any higher levels being due to minor fluctuations. The second view is that sea level reached a peak at about 10 feet above the present level around 3,000 to 4,000 years ago, and is now starting to drop at a very slow rate.

It is not possible to solve this problem by making present-day measurements over short periods of time. We would need the overall effect of the sum of fluctuations over the next thousand years. However, as with any scientific question, when one avenue of evidence leads to two possible interpretations, we can turn to another, independent avenue of investigation to try to "break the tie."

TEN YEARS ago, Dr. Cesare Emiliani of the University of Chicago completed a monumental piece of work which bears directly on this problem (reference 2). He examined the average temperature record of ocean waters over the last 325,000 years by an ingenious method devised by Nobel Prize winner, Harold Urey. The method is based on the fact that the chemical element, oxygen, has two important isotopes, oxygen-16 and oxygen-18. An isotope of a chemical element is the name given to atoms of that element which are the same in every way as the element's other atoms, except they weigh a little more or less. In the case of oxygen atoms, one out of every 500 present on the earth weighs a little more than the other 499 of them. That is, there is one oxygen-18 atom to every 499 oxygen-16 atoms.

It is known that the microscopic animals called plankton, billions of which occur throughout the oceans of the world, deposit minute shells around themselves. These shells are composed of several chemical elements, including oxygen. Urey determined that the percentage of oxygen-18 relative to oxygen-16 in plankton shell material increased when the average temperature of the ocean water decreased. So Emiliani collected the fossil shell remains of microscopic plankton from sediment cores dug from ocean bottoms. These remains covered a span of over 300,000 years into the past. Careful analyses of the proportions of oxygen-18 to oxygen-16 were performed and then translated into average temperatures of the oceans in which the plankton lived. The results are shown in the graph in Fig. 2.

In this graph, each of the temperature highs corresponds to a major or minor glacial interstage, and each of the lows to a major or minor glacial advance. It should be noted that the difference in temperatures from the lows to the highs is only about 11°, from 73°F. to 84°F. Emiliani collected his fossil specimens mostly from lower latitudes where temperatures would not have dropped severely even during a glaciation in higher latitudes. In lower lati-

(Continued on page 8)

the FLEMINGS of KATHMANDU

melvin a. traylor, jr.
associate curator of birds

ABOUT a year ago there was published *The Fabulous Flemings of Kathmandu*[1], the story of Drs. Robert and Bethel Fleming and the United Christian Medical Mission to Nepal. It is an inspiring story, first, of their struggles to get permission to enter the country, and then of the growth of the mission from a small clinic in Kathmandu to modern hospitals in Kathmandu and Tansen and numerous clinics in outlying villages.

No one who reads this book could fail to be stirred by the courage and dedication of Bob Fleming as superintendent of the mission, and his wife, Bethel Fleming, as medical chief of the hospital. Their contribution to the people of Nepal in introducing modern medicine can only be appreciated when it is realized that as recently as 15 years ago foreigners were barred from the country and there was no medical service in our sense of the word at all.

However, while we at the Museum are proud of the Flemings and the dedicated work that they are performing, we are also happy to realize that it was through Bob Fleming's association with the Museum that his first opportunity to visit Nepal arose. As Bob says, they entered Nepal "on the wings of a bird," and it was his interest in birds that brought him to the Museum, first as visitor, then as collector, and now as Field Associate and co-author of three publications on the birds of Nepal.

It was in 1937, when on leave from the Woodstock High School in Mussoorie, India, to earn his Ph.D. in education at the University of Chicago, that Fleming first came to the Museum. Seeing an Indian pheasant on exhibition that he considered to be mislabeled, he boldly requested permission to speak to the curator. Thus began an association that has brought to the Museum several thousand birds, and to Fleming the delight of traveling the length and breadth of India and eventually reaching Nepal. When Fleming realized that the Museum would actually pay him to pursue his passion for birds, he received a brief but intensive course in collecting—one chicken skinned jointly with curator Emmet R. Blake—and was sent on his way with the minimum of equipment and our most fulsome hopes. These were justified, for the accession cards for the following years read like a gazetteer of India—Punjab, Assam, Manipur, Mussoorie—as Fleming used his long Christmas vacations to further his collecting.

By 1949 Fleming's heart had settled on Nepal, still closed to foreigners but with a wealth of fascinating birds. However, a foot had been put in the door to Nepal by two Americans, Walter Koelz and Dillon Ripley, who had collected there the two previous years. In mingled hope and desperation Fleming requested permission to go there through our embassy in India. To his amazement, permission was granted almost immediately, and there ensued an eager period of preparation. Financial support was offered by the late Boardman Conover, Research Associate and Trustee of the Museum, and Dr. Bethel took over a 150-bed hospital at Fatehgarh so that Dr. Carl Taylor of the Presbyterian Mission could accompany Bob. In October of 1949 the party reached Tansen in west Nepal, and the next three months were spent collecting along the Kali Gandahk River, reaching within 30 miles of the Tibetan border and altitudes up to 18,000 feet.

Dr. Fleming examines a pheasant collected for the Museum (photograph by Toge Fujihira).

But exciting as he found the birds in this unknown country, Fleming was even more impressed by the tremendous need for medical assistance. Wherever he and Dr. Taylor camped word quickly spread that there was a doctor in the party, and soon there was a constant stream of patients arriving, all desperately needing attention. The slender medical resources that they had brought in with them were soon exhausted, and Fleming realized that medical work was the most important way in which his mission could help the Nepalese. This belief was the genesis of the United Christian Medical Mission to Nepal, although its consummation was to require another four years.

Although the first request to start a medical clinic in Nepal was refused, the friends that Fleming had made among the governing Rana family asked him to return, both to

collect and to bring medical assistance. In October of 1951 he was back again in west Nepal, this time accompanied by Dr. Bethel, son Bob, and the Dr. Carl Friedericks. While the two Bobs were off collecting, the two doctors established a clinic in Tansen. After treating 1,500 patients in 40 days, they returned to India even more convinced that their mission lay in Nepal. Again, though, they were disappointed when their request was not granted. It was not till 1953 that they were to succeed.

In January of that year the Flemings were able to make their first trip to Kathmandu, the capital of the country. By now the political climate had changed, the king had been restored to power, and outside aid was being sought. After collecting in the hills around the Kathmandu Valley, Bob gave a lecture to 80 of the leading people of the capital, exhibiting his birds and explaining their hopes for the mission. Whether it was the impact of his sparkling personality (and it is a personality impossible to resist) or whether it was just that the time was ripe, not long after their return to Mussoorie they received word that their prayers had been fulfilled; they were invited to start a medical mission in Kathmandu and Tansen. By January, 1954, the mission, however modest in the beginning, was a reality, and its growth during the ensuing years is a fascinating part of Miss Fletcher's book. We at the Museum have followed that growth with affection and pride, for we have felt, however indirectly, that we have a part in the mission.

In the meantime, Dr. Fleming has not let the responsibilities of being superintendent of the medical mission keep him from his interest in birds. The results of his earlier trips were published in collaboration with Chief Curator of Zoology, Austin L. Rand[2], and subsequent vacation periods have found Fleming always in the field. His travels have taken him from Nepal's far western border with Garhwal to the far eastern border with Sikkim, and it is doubtful if any man, foreigner or Nepalese, has seen as much of the country as he. In 1960–61 he participated in the World Book Scientific Expedition to the Himalayas, and I have had the pleasure of collaborating with him in publishing the results of these collections[3]. During this past year he has been able to devote full time to his scientific efforts through the medium of a Fulbright grant.

Young Bob, Jr. has shared his father's interests since the early days when he first accompanied him into the field. He himself is now teaching at Woodstock School and working on his Ph.D. thesis, which will be, naturally enough, on the birds of the Himalayas, This is good news for all of us, for it puts off indefinitely the day when we need be concerned that there will be no Flemings associated with the ornithology of India. ■

[1] Grace Nies Fletcher. *The Fabulous Flemings of Kathmandu* (New York: E. P. Dutton and Company, 1964).

[2] Rand, A. L. and Fleming, R. L. "Birds from Nepal," *Fieldiana: Zoology*, Vol. 41, 1957, pp. 1–218.

[3] Fleming, R. L. and Traylor, M. A. "Notes on Nepal Birds," *Fieldiana: Zoology*, Vol. 35, 1961, pp. 447–487.

[4] ——."Further Notes on Nepal Birds," *ibid.*, 1964, pp. 495–558.

MUSEUM NEWS

Summer Programs For Children

The Museum's summer series of free movies for children begins July 8 and runs for six successive Thursdays. The programs on the last four dates are scheduled so that children may attend the Grant Park Young People's Concerts at 11:00 A.M.

July 8 *10 and 11:15 A.M.*

The Restless Sea

Story of one of the "New Frontiers" in science: the sea's currents, tides, bizarre plants and fish, and the effects of volcanoes on the ocean floor.

July 15 *10 and 11:00 A.M.*

The Enduring Wilderness

Some of the scenic areas of Canada, where native plants and animals are being preserved for our enjoyment.

Cartoon also

July 22 *10 and 1 P.M.*

Tales of Children

How children live in the mountain villages of southern Spain and Bolivia and the fiord country of Norway.

July 29 *10 and 1 P.M.*

Animals

From Latin American jungles to our own area. Cartoon also

August 5 *10 and 1 P.M.*

Australia

The strange and interesting creatures of the continent "down under."

August 12 *10 and 1 P.M.*

Ranch Life

Early days in California and a little spoofing of Western movies.

Cartoon also

South American Hall Reopens

The Hall of Ancient and Modern Indians of South America (Hall 9) is now reopened after having been closed since 1962. During that period the space occupied by the hall was remodeled to make room for a special exhibition area, adjacent to Stanley Field Hall, for the display of temporary exhibits.

Visitors to the reopened hall will find it rich in materials from the ancient cultures of Colombia and Peru and the recent Indian tribes that live in the tropical forests east of the Andes.

Among the archaeological materials are painted effigy and portrait jars which bring to life the ancient Chimu people, whose civilization reached its height in the eighth century of our era. Three new cases display the elegant pottery made from the first to the eighth century by the Nazca and Paracas peoples of Peru.

Outstanding among the artifacts made by recent Indians are ceremonial costumes used by the head-hunting Jivaros of Ecuador and Peru. On a backing of bark cloth or woven human hair, these dance skirts and headdresses boast intricate and lovely designs fashioned of shell, seeds, dyed bird bones, monkey

(*Continued on next page*)

OUR GEOLOGIC AGE

(*Continued from page 5*)

tudes, also, a complete fossil record is more likely to be present. It does not actually matter, of course, where the cores were collected, for the relative changes in temperature, and when they occurred, remain the same. Oceanic temperature changes are always very much less than those on the continents. This is because it takes a very long time to change the temperature of a large body of water, whereas it takes only a short time to change the temperature of air.

From Fig. 2 we see that there are seven highs and seven lows. All the highs are around 84°F., whereas the lows vary considerably, corresponding to major or minor glacial advances. The most recent low occurs at 18,000 years ago, marking the most recent glacial advance (which, incidentally, covered Chicago). Referring back to Fig. 1, we see that the sea level was at its lowest just about 18,000 years ago. Thus two independent lines of evidence give the same result. This is always encouraging. In addition, Emiliani has calculated that the maximum drop in sea level could have been *at most* 325 feet. Fig. 1 shows an approximate drop of 310 feet, which is quite close to his predicted value.

On the other hand, the graph showing sea level change shows a peak around 35,000 to 40,000 years ago, while the graph for temperature change shows a minor broad peak at 77°F. around 45,000 to 50,000 years ago. This difference can be explained by the lag between changes in temperature and sea level. For example, when temperatures gradually drop, more and more water remains frozen on land, thus dropping sea level almost as quickly as the cooling trend sets in. But when a warming trend begins, and large masses of ice begin to decay and melt, not all the melt water returns to the oceans right away. Due to the weight of the ice sheet, the ground underneath is often depressed in shallow basins which become new lakes. Also, glaciers carry and deposit large quantities of broken rock, called glacial till, which often dam up the rivers and creeks through which drainage had previously occurred. The lake country of northern Wisconsin, Michigan, Minnesota, and Ontario is an example of a region just recently glaciated. Most of these lakes are decreasing in size as the drainage paths to the oceans become unclogged. Thus, after a temperature rise and glacial decay and retreat, it will take several thousand years for all the melt water to drain off to the sea and raise it to its preglacial level.

From Fig. 2 we see that the average oceanic temperature reached a maximum about 6,000 to 7,000 years ago, and has dropped since then. Here, then, appears to be the answer to the problem of interpreting recent sea level changes. It seems that a peak in sea level could have occurred 3,000 to 4,000 years ago. This would mean about a 3,000 year lag between temperature peak and sea level peak, and it indicates that sea level is averaging a slow rate of drop at present.

What does this mean? If we project the sea level drop into the future, in a smooth continuation of the curve in Fig. 1, we find a "trough" at about 15,000 years from now (Fig. 3). Emiliani, on the basis of the temperature drop over the past 6,000 years (Fig. 2) predicts the beginning of another glacial advance in about 10,000 years. This would put the maximum glaciation at about 15,000 years from now!

Here then, is the answer to our original question. We live in the Pleistocene Epoch still. Our whole civilization has been born and has grown in the seventh glacial interstage (Fig. 2). Ten thousand to 15,000 years sounds far off, as indeed it is. Human beings, however, have been around almost two million years. Our ancestors have lived through seven glaciations already. It is not likely that our descendents, 500 generations from now, will succumb to so well-known an enemy as the eighth glacial advance from the north. ■

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3. RUSSELL, R. J. *Science* (Washington, D. C.), Vol. 139, 1963, pp. 9–15.
4. SHEPARD, F. P. *Ibid.*, Vol. 143, 1964, pp. 574–576.
5. VAN ANDEL, T. H. *Ibid.*, Vol. 145, 1964, pp. 580–581.

MUSEUM NEWS

(*Continued from page 7*)

teeth, and beetle wings. A new case shows examples just received by the museum of brilliant featherwork made by the Urubu Indians of Brazil. ■

This shrunken human head, thought to be of a European woman, is one of four such specimens once more displayed in Hall 9.

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 36 No. 8

August 1965

George I. Quimby, Curator
North American Archaeology and Ethnology

Exploring an Underwater Indian Site

THE FIRST underwater exploration of an Indian village site on the bottom of Lake Superior was undertaken jointly by Chicago Natural History Museum and The University of Michigan's Museum of Anthropology on June 19 in the cold waters off Naomikong Point in Chippewa County, Michigan.

Discoveries made by the diving members of the expedition showed that the site was an Indian village of the Middle Woodland period occupied at about the time of Christ and subsequently submerged under rising water levels.

But we are getting ahead of our story. How this expedition came into being and why we chose Naomikong Point is an important part of our narrative.

In the last few years Mr. C. Sprague Taylor, lumberman and historian of Newberry, Michigan, and his son, Charles, had noted flint arrowheads and fragments of pottery on the beach at Naomikong Point. In the winter of 1963 Mr. Taylor brought photographs of some of these artifacts to Chicago Natural History Museum for me to examine. And in October of 1964 Mr. James R. Getz, Museum Field Associate, and I visited the Naomikong Point site in the company of Mr. Taylor and his son.

Collecting conditions were not ideal at the time. Snow covered the ground to a depth of several inches, a north wind swept over Lake Superior, and fresh bear tracks crossed the trail into the site. Nonetheless a number of water-worn artifacts were found on the beach and some were even observed being tossed up by the waves. It was obvious that the specimens were coming from beneath the water, but the big question was this: was there really an ancient Indian village site on the bottom of Lake Superior or had the artifacts been washed into the lake by wave action cutting into the shore? The question could only be answered by exploring the Lake Superior waters off Naomikong Point.

In the spring of 1965 we made our plans for an underwater archaeological survey of the area. We would use divers, establish a system of measurement, and study the landward side of the beach as well as the lake bottom. If the site looked promising a University of Michigan field party would conduct intensive investigations later in the season, under the direction of Dr. James B. Fitting, Curator of the

COVER: *Mrs. Marilyn Fifield (left) checks equipment for underwater photography of 2,000-year-old Indian village site on bottom of Lake Superior. Diving with her is John Quimby (right).*

Left: *Preparing to dive.*

Inset: *Dr. James Fitting examines artifacts brought up from the sunken village.*

(Photographs by C. S. Taylor.)

Great Lakes Division of the University's Museum of Anthropology.[1] We notified Mr. Taylor of our intentions and the University of Michigan applied to the United States Forest Service, custodian of the land, for a permit to excavate.

On May 30, in a plane piloted by Mr. and Mrs. Thomas B. Fifield of Milwaukee, Wisconsin, I flew over the area in an effort to determine if any cultural remains under water could be seen from the air. Although we maintained an elevation of less than 400 feet, bad weather hampered our objective and we shifted our aerial operations to sites in the Lake Michigan basin.

Meanwhile, back at Naomikong Point, some expert surveying was under way. A professional surveyor, Mr. Eino Sainio, assisted by Mr. Taylor, precisely located and restored the meander corner on the shore between sections 8 and 9 and set station posts 100 feet apart along the shore line. These station posts were to be our reference points for all measurements made under water. By means of 100-foot ropes marked in ten-foot sections and sightings by engineers' compasses we would be able to locate accurately and map the position of all underwater finds.

We were now ready and the exploration date was set for Saturday, June 19.

[1] I would like to express my appreciation to Dr. Fitting for supplying his analyses of the data described in this article.

derwater photograph of 2,000-year-old pottery vessel in situ off shore Naomikong Point, Michigan. (Photograph by Marilyn Fifield.)

On the appointed day we assembled at our meeting place. Most important to our expedition was the presence of Mr. Richard Ruppenthal, not only because as District Ranger of the Hiawatha National Forest he was in charge of the area we were entering, but also because he had a large truck with 4-wheel drive that could carry our divers and all of our equipment through the woods to the shore of Lake Superior.

With Mr. Ruppenthal was Mr. Herman Cameron, President of the Bay Mills Indian Council, whose ancestors had lived at Naomikong Point.

Our divers were Mr. and Mrs. Fifield, their son, George, and my son, John. Mr. Taylor acted as expedition photographer, and the land-bound archaeologists consisted of James Getz, Dr. Fitting, and myself.

Mrs. Molly Fitting acted as recorder and Mr. Donald Janzen, graduate student at the University of Michigan, catalogued the finds as they were brought ashore.

Those of us on foot walked down the rough logging road to Lake Superior, following the truck that carried our divers and equipment. Where there had been falling snowflakes on our October trek to the site, there were now large mosquitos in the same abundance.

Upon reaching the shore, we unloaded the truck and carried our equipment across a small neck of land to the site. The four divers put on their wet-suits, masks, weights, tanks, snorkels, and whatever else they needed, then placed our red and white diving flags on buoys anchored offshore some 300 feet.

The weather was ideal. Although the water temperature was in the 40's, the sun was shining, visibility was excellent, and the lake was calm.

The divers worked under water in 100-foot squares based on station posts set at 100-foot intervals along the shore. Pottery fragments and flint chips found by divers were placed in bags made of window screening. These were brought ashore and catalogued according to the 100-foot square in which they were found.

Special finds such as collapsed pottery vessels *in situ*, large clusters of sherds, or groups of fire-cracked stones indicative of hearths, were marked by buoys, stakes, or rock cairns by the diver, who then reported his discovery to the shore-based archaeologist in charge of that particular sector. Then the location of the find was fixed by measurement and compass direction from a shore point related to the line of station posts placed 100 feet apart. Next the find was photographed *in situ* under water; and finally it was carefully removed, placed in the screen bags, and brought ashore for recording, cataloguing, and analysis.

One of the archaeologically significant finds was that of a whole pot. Although it was broken, all of the pieces were in place on the lake bottom. Moreover, the sherds were encrusted with carbonized food remains, showing that the pot probably had broken while food was being cooked in it, and that broken pot, food and all, had fallen into the hearth where it remained until found by one of our divers.

(Please turn the page)

It was this find and several others that proved conclusively that there was a village site under water and that the artifacts had not just been washed into the lake by wave erosion of the shore. For one thing, wave action would have resulted in considerable smoothing of the pottery. It would look as if it had been sanded. Moreover, the carbonized encrustation would have been worn away. And, finally, the broken pieces would have been scattered around and would not have been found in one place.

The other significant finds bearing on this problem were hearths marked by clusters of fire-cracked stones, and a pottery sherd with powdered red ocher still adhering to it. The hearths could not have been washed into place and the powdered red ocher would not have remained on the sherd if it had been tumbled in sand and rock by wave action.

Thus the evidence clearly shows that there is an Indian village site beneath the waters of Lake Superior just off Naomikong Point. The explorations of our divers indicate that the ancient village extended in an east-west direction for about 500 feet and up to about 300 feet along a north-south axis. However, since this was a limited and preliminary survey the explorations are incomplete and the village area may turn out to be larger than this.

The age of the site can be determined by the kind of pottery found in it. The pottery found by our divers consisted of Middle Woodland types which elsewhere have been radiocarbon dated at 200 B.C. to about A.D. 200.

This pottery was made of fired clay tempered with small particles of stone and decorated with various kinds of stamped impressions. The kinds of stamps used in decorating the pottery included pseudo-scallop shell, and bar and dentate stamps.

The 300 or so sherds collected were studied and analyzed in detail at the University of Michigan. According to Dr. Fitting, the overall distribution of the kinds of Middle Woodland pottery found at Naomikong Point is co-terminus with a zone of pine-hemlock-northern hardwood forest that extends westward from New York to Manitoba. This zone is called the Lake Forest formation. And since the various manifestations of Middle Woodland culture found within this zone seem to be generally related to each other, Dr. Fitting believes that the name "Lake Forest Middle Woodland" would be an apt term for the entire regional tradition.

Local expressions of this tradition, however, are recognizably different from each other and can be separated as cultural variants; thus the Naomikong Point finds are a new variant of the Lake Forest Middle Woodland. Other manifestations of the Naomikong Point variant may be found on the south shore of Lake Superior at some future date. At the present time its closest relationships are with Middle Woodland materials found recently at a site on Isle Royale and at another site on Bois Blanc Island near Mackinac Strait.

How did an Indian village site that existed 2,000 years ago come to be under the waters of Lake Superior in 1965?

We know from geological evidence that the north shore of Lake Superior has been rising for thousands of years and is still rising. Between the Nipissing stage of about 3000 B.C. and the present, the north shore has been upwarped at least a hundred feet in some areas.

This upwarping is caused by expansion of the land that had been compressed by the tremendous weight of the ice in the continental glaciers that covered the area for thousands of years during the last Ice Age. When the glacial ice melted, the land began to rise. And since the north shore is rising more than the south shore the waters are flooding or drowning the south shore.

If one can picture a tilted basin with one side up higher than another, one can visualize how the waterward margins of the low side become submerged even though the volume and level of water remain unchanged. This situation is analogous to what has happened to the south side of Lake Superior.

The Middle Woodland Indians living at the time of Christ probably had a village some considerable distance from the lake shore. In all likelihood this site was covered by humus or by blown sands after it was abandoned by these Indians. In any case, it seems likely that the Middle Woodland occupational debris was buried before encroachment of the water.

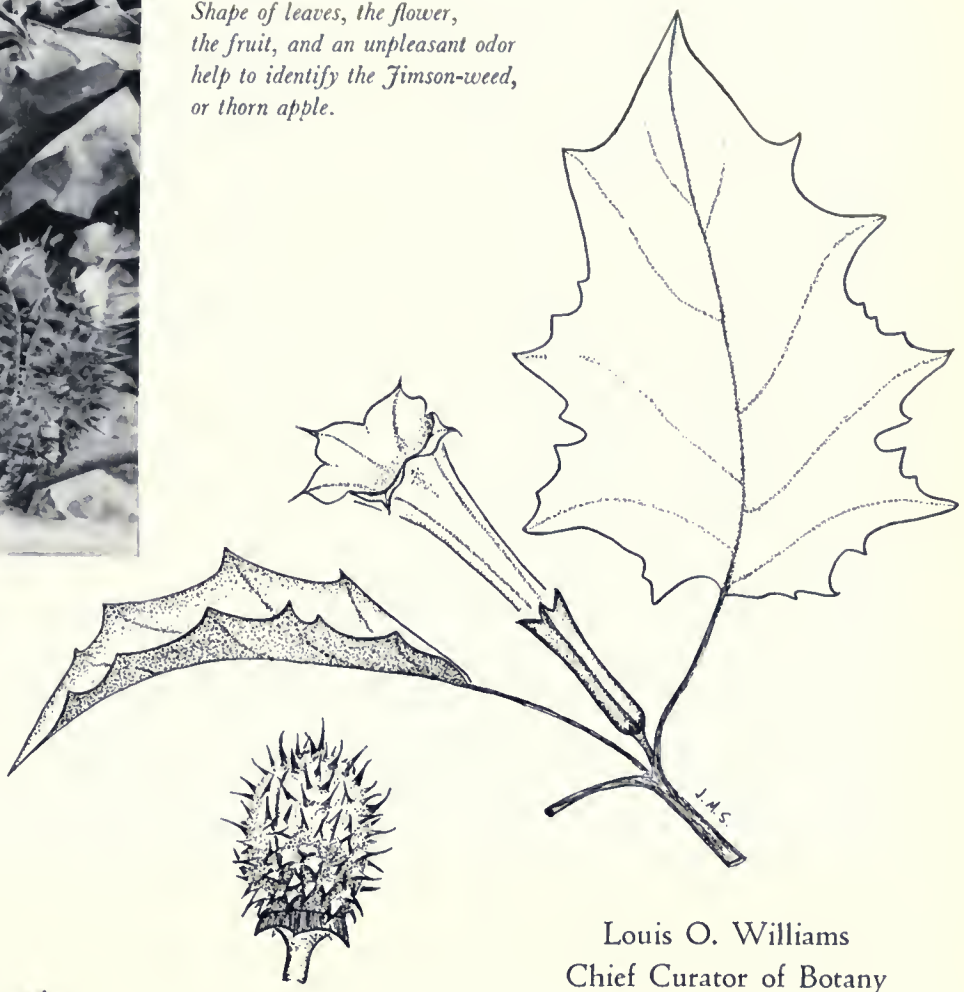
Then, as the shore line receded before the eroding waters washing on it because of the tilting of the Lake Superior basin, the buried village site became submerged. Wave action destroyed the soils and any cultural levels above the Middle Woodland village, but did not cut into the site itself probably until this century.

Now the waves are excavating the top portions of the old village which at the present time is on the bottom of Lake Superior. And it was this wave-excavated part of the 2,000-year-old site that was seen and surveyed by our divers on this first underwater exploration of a Middle Woodland village site in the Upper Great Lakes region. ■

Above: *Fragments of pottery, decorated with stamped impressions, found in the underwater site.*

Left: *Ancient knives of chipped quartzite from the bottom of Lake Superior.* (*Photographs by Dr. James Fitting.*)

Shape of leaves, the flower, the fruit, and an unpleasant odor help to identify the Jimson-weed, or thorn apple.



Louis O. Williams
Chief Curator of Botany

THORN APPLES ARE NOT FOR EATING

THE FAMILY of plants to which the potato belongs is popularly called the potato, or nightshade, family. Botanists universally refer to the family as "the Solanaceae." This large and, to man, important group of plants contains members that produce such foods as potatoes, tomatoes, sweet and hot peppers, and eggplants. Tobacco is also an economically important member of the family; and several drugs come from the Solanaceae. An old and important drug is belladonna, used to relieve pain. Atropine, commonly used by oculists to dilate the pupil of the eye to facilitate examination, comes from the same plant. Several ornamentals are also found in the family: petunias, so conspicuous in annual plantings around Chicago, are an example.

Weeds are to be found in the potato family, too. Weeds have been defined as "plants out of place." One of these plants is the Jimson-weed, which is also called thorn apple, Jamestown-weed, apple-of-Peru, and stramonium. When the spiny fruits are conspicuous then perhaps the commonest name is "thorn apple." Stramonium is the name of the drug that comes from this plant; it is an alkaloid that is used much as is belladonna.

Vacant lots and cultivated fields around Chicago often contain plants of Jimson-weed, which is probably a native of America. Normally no one would pay much attention to the plants if it were not that children sometimes pick the thorn apples and test them out to see if they are good to eat. All parts of the Jimson-weed are toxic but the seeds contain a greater amount of the toxic alkaloid than do other parts of the plant.

Every year the Museum receives frantic telephone calls about children who have eaten a plant and are sick. The plant described and the symptoms given often indicate that another child has experimented with thorn apples.

Symptoms that may be present in poisoning from Jimson-weed include: dilated pupils, delirium, thirst and dry mouth, lack of coordination, headache, nausea. If these symptoms, or part of them, appear in a child and it is suspected that he has eaten from a wild plant, he should be taken to a doctor or a hospital immediately.

In any plant poisoning, specimens of the plant causing the distress should be taken to the hospital so that they may be accurately identified, for not all poisons are treated in the same way.

The spiny fruit (half as big as your thumb to the size of a small egg), leaf shape, and the disagreeable odor of the plant will all help in the identification of this weed. We suggest that you destroy Jimson-weeds around your property, or if there are too many, then show them to children and explain that they are not to be eaten. ■

A youngster attending last year's workshop proudly displays his insect collection.

An invitation to

FALL WORKSHOPS for MEMBERS' CHILDREN

AN OPPORTUNITY to meet Museum staff, and work with specimens and materials from the Museum's scientific collections, is again offered in a series of unique workshops open to the children and grandchildren of Members. These workshops will be held on Saturdays in October.

Designed by the Raymond Foundation to stimulate and develop interest in the study of nature and man, the workshops have been enthusiastically received by Museum Members and their families since the fall of 1963.

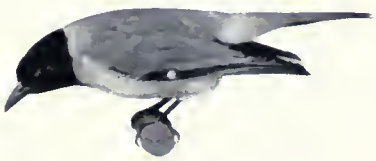
This year, classes are offered for four different age groups: there are seven sessions for boys and girls aged 10 through 13; two for children aged 8 and 9; two for those 6 through 9; and one for children 6 and 7. All workshops last about one and one-half hours.

Reservations are necessary, and an application form is enclosed with this month's BULLETIN. Since workshops are limited to small groups, and it is not always possible to accommodate all applicants, we urge you to mail in your reservations early. Reservations will be accepted in the order in which they are received. Each applicant accepted will receive a confirmation card which will serve as an admission card to the workshops.

Following is a complete schedule of dates, hours, and workshop subjects:

October 2
Indians of the Woodlands and Plains
10:30 A.M. or 1:30 P.M.
For ages 10–13
Harriet Smith in charge

In different regions, Indian tribes developed a life that fitted their kind of country by exploiting materials furnished by nature. In this workshop, youngsters will handle these raw materials and see for themselves how their qualities were utilized in the making of tools, weapons, and household equipment. Movies that show how Indian tribes lived in the woodlands and western plains before the settlers came give a basis for class discussions comparing different Indian ways of life.



October 2
Birds
10:30 A.M. for ages 6–9
1:30 P.M. for ages 10–13
George Fricke in charge

What birds live in the Chicago area? How can we attract them to our yards? This workshop introduces youngsters to the common birds whose appearance and habits should be familiar to all. In both sessions, study of feathers and Museum specimens will help tell the story of birds.

October 9
Insects
10:30 A.M. for ages 6–9
1:30 P.M. for ages 10–13
George Fricke in charge

Insects are the easiest animals to collect, and October is still early enough to start your own collection if you know where to look and how to begin. This workshop will help boys and girls to identify insects of the Chicago area, and to make their own collection.

October 16
Cave Man to Civilization
10:30 A.M. or 1:30 P.M.
For ages 10–13
Edith Fleming in charge

A movie on the life of the cave men, which shows how they hunted prehistoric animals, opens this workshop. In the following discussion-demonstration period, boys and girls will examine real tools used by cave men thousands of years ago, learn how they were made, and compare them with tools of today.

October 16
Boneyard Zoo
10:30 A.M. or 1:30 P.M.
For ages 6–7
Ernest Roscoe in charge

Fossil remains of ancient fish, amphibians, reptiles, birds, and mammals will be investigated in the exhibition halls and through examination of specimens.

October 23
"Rockology"
10:30 A.M. for ages 8–9
Ernest Roscoe in charge

A beginner's introduction to rocks and minerals by means of specimen study, demonstrations, and informative sessions in the exhibition halls. Topics include: what are rocks? how are they formed? what characteristics are useful in identifying rocks and minerals?

October 23
Rock and Mineral Kingdom
1:30 P.M. for ages 10–13
Ernest Roscoe in charge

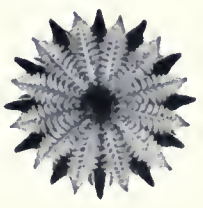
A more advanced program on rocks and minerals. Included is practice identification of specimens with the aid of a key.

October 23
Spices: Trail-Blazers to New Lands
10:30 A.M. or 1:30 P.M.
For ages 10–13
Marie Svoboda in charge

Spices were once so much in demand that the search for them drew explorers to strange and distant lands. What were these spices worth their weight in gold? Where did they come from? How do we use them today? Boys and girls will have a chance to explore these questions by means of specimens and exhibits.

October 30
World of Fossils
10:30 A.M. for ages 8–9
Ernest Roscoe in charge

Youngsters will learn the main ways in which plants and animals become fossils, and how to identify the major groups. Stress is on the fossils likely to be found in the Chicago area. Highlights of the session include a movie and work with specimens.



October 30
Life Through the Ages
1:30 P.M. for ages 10–13
Ernest Roscoe in charge

An introduction to geology from the historical point of view, including the development of plants and animals from the Cambrian Period to the Ice Age. The session offers a movie and work in the exhibition halls with question sheets, as well as handling of specimens. ■

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

Mrs. Meta P. Howell, Museum Librarian, and Mr. Allen P. Stultz, President of the American National Bank and Trust Company of Chicago, view the exhibit on the Museum's Library in one of the bank's windows overlooking Washington Street, near LaSalle Street, in Chicago.

THE MUSEUM LIBRARY ON EXHIBIT

Chicago's banking and financial center along LaSalle Street is enlivened these days by a series of exhibits in the windows of the American National Bank and Trust Company of Chicago. Entitled "A Salute to Chicago's Libraries," the displays call attention to the many technical, research, and other specialized libraries that provide essential resources for the continuing growth of the city's intellectual and cultural life.

The Museum Library, under the leadership of Mrs. Meta P. Howell, Librarian, has been pleased to cooperate in the setting up of the window display on Chicago Natural History Museum. With the help of Mr. John R. Millar, Chief Curator Emeritus of Botany, a colorful and varied group of materials from the Museum collections has been assembled to illustrate the relationship of the Library to Museum scholarly and scientific inquiry.

Museum Members are well aware of the important services that the Library furnishes not only to the Museum staff but to scientific colleagues resident or visiting in the city, and (through interlibrary loan) in other parts of the country. The Library is also responsible for an exchange of publications with major educational and scientific institutions in nearly every country of the world. In an article published in the May, 1965, BULLETIN, Mrs. Howell described the Library's holdings and services, and outlined the major expansion of its facilities which has just been completed.

Prehistorian Appointed

When the Museum's hall on the Stone Age of the Old World (Hall C) was completed in 1933, the latest theories on prehistoric man were incorporated in the exhibits. As many new discoveries have been made since that time, planning for re-installation of the hall will be one of the major projects to be undertaken by the Museum's new Assistant Curator of Prehistory in the Department of Anthropology.

Dr. Glen H. Cole was appointed to this position as of June 1, 1965. His two-year appointment has been made with the assistance of a grant from the Wenner-Gren Foundation for Anthropological Research.

Dr. Cole will also make an inventory and assessment of the Museum's European and African prehistory collections, and do research on the paleolithic cultures of East Africa and South Arabia.

Dr. Cole is a graduate of Reed College and received his Ph.D. in anthropology from the University of Chicago. He has done archaeological field work in Illinois, Colorado, northern Mexico, Arabia, and in East, Central and South Africa. ■

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CHICAGO NATURAL HISTORY MUSEUM
Bulletin
Vol. 36 No. 9
September 1965

Wet-blasting. Walter C. Reese, Preparator.

New Conservation Laboratory is Opened

Donald Collier
Chief Curator, Anthropology

Photographs by the Division of Photography

AFTER several years of study and planning, the Museum has recently opened a conservation laboratory in the Department of Anthropology. This new facility was made possible by generous grants from the Wenner-Gren Foundation for Anthropological Research in New York and the Robert R. McCormick Trust in Chicago. The laboratory, which will be dedicated formally this fall, has been named the Robert R. McCormick Conservation Laboratory.

The purpose of the new laboratory, which is operated by Mrs. Christine Danziger, Conservator, is to preserve the hundreds of thousands of rare and irreplaceable specimens in the Museum's anthropology collections. These specimens are of varying ages from ancient to modern and come from all parts of the world. They are made of a great variety of materials, including stone, minerals, metal, pottery, glass, bone, ivory, horn, shell, wood, vegetable fibers and gums, fur, leather, rawhide, feathers, paper, and bark cloth. Each of these materials involves particular problems of conservation and some are much more perishable than others. Because of this diversity a very wide range of techniques and procedures is needed to preserve the collections.

The new laboratory is divided into three sections. The first contains the conservator's office with space for the conservation library and the storage of conservation records. A detailed record is kept of every specimen treated in the laboratory. Also in this room are an area for the examination of specimens as they enter the laboratory and facilities for chemical analysis of specimens. There is an adjoining storage room for supplies and equipment and for holding specimens in various stages of treatment.

The second section of the laboratory contains the x-ray installation. The 150-kilovolt industrial x-ray machine is used in the diagnosis of specimens needing treatment, especially the metal objects. Next to the x-ray room are a dark room for developing film, and a small room for the study of x-ray pictures and the viewing of specimens in ultra-violet light. The corridor off these rooms contains a refrigerator for storing film and chemicals and space for a vacuum oven. The latter is used to dry specimens and to impregnate them with preservatives.

The third section is devoted to the cleaning and treatment of specimens. It is equipped with ample washing facilities, an apparatus for demineralizing water, equipment for electrolytic treatment of metals, and a chemical fume hood for carrying on procedures involving explosive or toxic chemicals. There are abundant electrical outlets, supplies of gas and compressed air, and additional plumbing outlets for future expansion of the washing facilities.

One of the most complex problems in conservation is the preservation of ancient metal objects. The Museum has a large number of archaeological specimens of copper, bronze, and silver from ancient Italy, Egypt, Persia, and China. Many of these are badly corroded. Of particular concern are the bronzes suffering from "bronze disease," a form of continuing corrosion caused by chloride salts which contaminate specimens while buried in the ground. We decided to devote the first major effort of the conservation laboratory to the treating of these metal objects, although work on other types of specimens would be carried on also.

A special problem came up in the treatment of Tibetan specimens in conjunction with the planned reinstallation of the Tibetan exhibition hall. Several hundred vessels, figurines, and ornaments of copper, brass, silver, or a combination

of these needed to be cleaned for exhibition. These date from the nineteenth and early twentieth centuries. We desired that they be bright and polished—just as they were when displayed on altars in the lamasaries. The specimens were badly tarnished and many were covered with a brownish lacquer which was very difficult to remove. Hand polishing was extremely time consuming and not completely effective.

After much investigation and experimentation, Mrs. Danziger concluded that the job could be done mechanically. The necessary equipment was acquired and installed near the laboratory. First the objects are wet-blasted with spherical glass beads of about the fineness of flour grains. This treatment removes soot, grease, lacquer, and most of the tarnish.

Cover: "*Dancing Ghosts.*" *These brass religious objects from Tibet have recently been cleaned and polished in the Robert R. McCormick Conservation Laboratory. The Museum's treasured collection of Tibetan materials is currently being restored for display in a new Tibetan hall.*

X-ray diagnosis of specimens. Mrs. Christine Danziger, Conservator.

Cleaning and treatment room.

Polishing mill.

Then the specimens are placed in a vibrating polishing mill which contains small ceramic cylinders moistened with a detergent and a corrosion inhibitor. The objects emerge beautifully polished and absolutely clean. The silver ornaments receive an additional silicone coating to prevent tarnishing.

The conservation laboratory was planned by the writer and Mr. Phillip H. Lewis, Curator of Primitive Art, in constant consultation with Mrs. Danziger. The new laboratory is open and the conservation program is launched. But it will be several years before all aspects of the program are fully developed and we have solutions to the various problems that face us. And during this period we shall adopt new methods and techniques as they emerge from the rapidly developing field of scientific conservation. ■

Summer Classes a Success

Ernest Roscoe (right) *with group of teachers attending Museum's summer course in earth science*

Both students and teachers spent part of their vacations attending classes at the Museum this year.

A course in earth science, sponsored by the Museum's Raymond Foundation, was attended by 31 elementary teachers from the Chicago area. The course was designed to give participants an opportunity to explore the scope of earth science and its application to the Chicago school curriculum.

Five course sessions were conducted by Ernest Roscoe, guide-lecturer in geology for the Raymond Foundation. A final field session was led by Harry Changnon, Curator of Exhibits, Department of Geology.

According to Roscoe, the recent addition of geology to the science curricula of secondary schools is now being felt at elementary school levels; many educators suggest that earth science now be introduced in the primary grades. At the same time, most elementary teachers have had little or no training in this subject. It was to meet this need that the Raymond Foundation decided to offer a pilot course during the summer.

"Our limited time did not permit us to more than scratch the surface of this large subject," Roscoe said, "but judging from the responses received from the participants, the program proved very beneficial."

"We feel," wrote two young teachers just beginning their careers, "that the earth science course will be extremely helpful in our future teaching." Another teacher wrote: "This workshop gave us a 'bird's-eye-view' which I feel was essential as a first step, especially for those of us with no college geology to draw upon." Especially gratifying was the comment: "My only regrets are that I did not discover earlier the thrill of this science and that the course was too short."

Miss Miriam Wood, Chief of the Raymond Foundation, and her staff hope that an expanded program can be offered next summer based on the experience gained from this pilot project.

The summer program for selected high school students, offered for the second year, was a series of seminars on science and man. Designed to augment the students' knowledge of biology and geology and to provide an introduction to anthropology, the seminars featured work with Museum specimens and discussions with the scientific staff. The seminars were conducted by Miss Edith Fleming, Miss Harriet Smith, and Miss Marie Svoboda, guide-lecturers in anthropology, archaeology, and botany; and Mr. Roscoe. ■

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Fall Journey

"Calico rock" (bleached sandstone)

Few children who played on the beaches of Lake Michigan this summer realized that the sand around them may have concealed countless sapphires, topazes, and rubies. A pirate's treasure? No. The gems—tiny ones, it's true—are among the more than thirty minerals that make up the beach sand.

The fascinating story of a "commonplace" material, sand, is the subject of the Museum's new fall Journey, "The Sands of Time."

Children taking the self-guided Journey through the Museum exhibition halls will learn how sand is formed, how it is carried for miles by wind, water, and ice and heaped into dunes and moraines.

The exhibits show the most common minerals found in sand, and explain their characteristics.

On the Journey youngsters may be surprised to discover that sand is highly valued—not for its minuscule gem fragments—but for its many economic uses: as an abrasive, as a soil lightener, as a primary ingredient in glass, and as a building material.

Boys and girls interested in taking the new fall Journey, "The Sands of Time," may pick up their tour directions at the Museum doors.

The Journey is available from September through November. ■

Staff Notes

Robert Stolze

Two Department of Botany members, Dr. Patricio Ponce de Leon and Mr. Robert Stolze, made a collecting trip to the Big Horn Mountains of Wyoming during June and July. Among other interesting places, they were able to go afoot into the Cloud's Peak Wilderness area, where there was still much snow in the passes of the "high country." Their collections of both flowering plants and cryptogams may be the first from this region. Duplicates will be distributed to the Museum's correspondents as soon as they are ready.

Wyoming celebrated the 75th anniversary of statehood this year. Most men grew beards for the celebration. Mr. Stolze, who cooperated, is shown with "anniversary" beard seated at his "period" desk in the botany department.

Dr. Glen Cole, Assistant Curator of Prehistory in the Department of Anthropology, has recently returned from a conference held in Burg Wartenstein, Austria. Sponsored by the Wenner-Gren Foundation, the conference brought together geologists, paleontologists, and prehistorians from many countries to discuss a systematic approach to the study of early man in Africa during the later Tertiary and Quaternary periods. Before the conference, Dr. Cole studied African paleolithic materials in the museums of Spain and England.

Mr. Leon Siroto, Assistant Curator of African Ethnology, gave an illustrated lecture at Roosevelt University in connection with the university's training program for Peace Corps members planning to work in Sierra Leone, Africa.

A distinguished summer visitor was Dr. Rolf A. M. Brandt, from the Seato Medical Research Laboratory of the Department of Medical Zoology in Bangkok, Thailand. A parasitologist, Dr. Brandt came to the Museum to study its collections of freshwater snails as part of his research on the role of these animals in parasitology.

Dr. In-Cho Chung, Assistant Curator of Vascular Plants, has resigned from the Department of Botany to accept a teaching position at Chicago Teachers College.

Mrs. Paula R. Nelson, Public Relations Counsel and Managing Editor of the BULLETIN, has also resigned to become News Director for the Welfare Council of Metropolitan Chicago. ■

La Rochelle harbor.

Making fish nets. Both scenes from the October 16th film-lecture on France.

FALL LECTURES FOR ADULTS

ONCE MORE the Museum's fall series of film-lectures for adults projects a brilliant image of nature and people around the world.

All of the motion pictures are filmed in color, and presented personally by outstanding lecturers specializing in world travel and natural history.

The programs will be given in the James Simpson Theatre on Saturday afternoons at 2:30 P.M. from October 2 through November 27. Reserved seats are held for Museum Members until 2:25 P.M.

The complete schedule follows:

October 2

German Panorama

Alfred Wolff

Here is a fresh vantage point from which to enjoy the many-sided German scene. This new film, a distinguished addition to Alfred Wolff's *Know Your World* film series, shows us a land famed for its castles, folklore, dramatic history, sports, and scenery. Beginning with the fabulous treasures of the Emperor Charlemagne, the film transports us to Oberammergau, the Rhine castles, the Grand Prix auto race at Neubergring, medieval Rothenburg, a daring glider school, East and West Berlin. Accompanying every scene, Wolff's narration both informs and transmits his pleasure in finding beauty, art, and charm.

October 9

Malaysia

Margaret Baker

Formed by the merging of four British colonies—Singapore, Malaya, Sarawak, and North Borneo—Malaysia faces unfriendly neighbors without, and political disunity within. Margaret Baker knows the diverse peoples of this troubled area intimately, having owned a rubber plantation in Malaya and traveled widely throughout Southeast Asia. She has photographed the new nation in depth and detail: Kuala Lumpur, the capital; Prime Minister Rahman, the founder; and dissident Singapore, now a separate governmental unit. Contrasting with the rapidly changing political situation are scenes of everyday life on a rubber plantation and in the villages and cities. The result is an authoritative documentary that bespeaks the divided nation's geography and people; its present problems and its potential for the future.

October 16

Along the Rivers of France

Philip Walker

The total history of France comes to life along its rivers. From Le Havre, where Atlantic liners disembark their passengers, pleasure cruisers sail up the Seine to Rouen, where Joan of Arc was burned at the stake. Beyond, the Seine flows to Paris and to Fontainbleau, palace of Napoleon and the kings of France. The river Marne empties into the Seine from the Champagne country. Chateaux representing a centuries-old record of kings and queens line the valley of the Loire. The Garonne wends toward Bordeaux, the great wine center and harbor for Atlantic ships. Past Lyon and Avignon, the Rhone flows through Arles, a city made famous by Van Gogh and Gauguin but also an important Greek town as early as the sixth century B.C. Every bend discloses a newly fascinating scene until we reach Marseille and journey's end.

October 23

Today's Stone Age People
The Australian Aborigines

Jens Bjerre

In a nearly impenetrable land of sand dunes, stony deserts, and scorched plains live today some of the last survivors of primitive man. Jens Bjerre has sought them out in the Australian interior to record the customs of a race now almost extinct. His documentary probes the aborigine's religion and magic: we watch the ceremony for the big holy snake, and the initiation rituals that transfer the strength of the old hunters to the young men. The daily life of these Stone Age people, the tattooing of the young women by burning scars into their skin, the hazardous conditions and constant search for nourishment, are reminders of the contrasts in human culture that still remain in the world. There is a tense kangaroo hunt with wooden spears for weapons, and a glimpse of the totem dances through which the dancers ascend in trance to the Great Spirit.

Australian boomerang. Hall D, east.

October 30

Look to Finland

Hjordis K. Parker

The majestic forests of Finland tie into the daily lives of her people during all four seasons of the year. In mid-winter, lumbermen fell the trees and drive them down the turbulent rivers to the saw mills. Young champions run, race, and turn somersaults on the floating logs. Equally daring ski jumpers compete for our attention with graceful girl gymnasts, performing in the Helsinki stadium. At the nation's capital young people enjoy a traditional sauna bath, we meet President and Mrs. Kekkonen, and watch the nation's artisans creating the crafts that are famous around the world. Christmas is spent on a farm, among scenes of idyllic beauty.

(*Continued on next page*)

ADULT LECTURES

Scene from the October 30th film-lecture on Finland.

Then abroad to Lapland, where the Laplanders hold a reindeer round-up and compete in games under the midnight sun. Other highlights are the uncovering of a thousand-year-old Viking site, and an exploratory tour of Finnish architecture, from the castles and churches of the thirteenth century to the airy structures of modern times.

November 6

Monsoon Mosaic

India

Telford H. Work

As director of the Virus Research Center in Poona, India, Dr. Work specializes in the epidemiology of tropical diseases. His avocation is wildlife, which he has photographed in every inhabited continent. Dr. Work is especially familiar with the many and varied wild animal populations of India: Langur monkeys and Mysore elephants; spot-billed pelicans that nest near the Bay of Bengal; the paddybird that catches polliwogs in the rice fields; Sarus cranes, cousins of our "Whoopers"; and the cattle egret associated with India's sacred cattle. All are dependent on the monsoon wind which carries the rainy season to the parched land. Dr. Work has combined his lively records of each animal population into a delightful "mosaic," demonstrating that the wildlife of Kipling's India still abounds.

November 13

Scotland and Wales

Ed Lark

Though long a part of the British Empire, Scotland and Wales have retained their own character and individuality. The Welsh heritage permeates each scene of Lark's film as he moves his color cameras from countryside to industrial city of Swansea, from coal mining town to seaside or mountain resort. We view fishermen in their ancient coracles, and skilled mountaineers; linger at the birthplace of Lawrence of Arabia and at the famed International Eisteddfod Folk Festival. On turning to Scotland, Lark shows us Stone Age dwellings and medieval castles, and traces the story of the kilt. There are visits to Ayr, where Robert Burns lived, and to Balmoral Castle, home of Queen Elizabeth. We tour all the major cities—Edinburgh, Glasgow, Aberdeen; the Highlands; Loch Ness and Loch Lomond; and the unspoiled Scottish isles—Skye, the Orkneys, and the Shetlands.

November 20

A Second Look at Africa

Arthur C. Twomey

Following up his film, *Changing Heart of Africa*, Arthur C. Twomey's second look at the African continent is to the east. There, Kenya, Uganda, and Tanganyika—which has united with Zanzibar to form Tanzania—are countries on the move. What is it like in East Africa today? Dr. Twomey seeks answers to this question in his film-study of three new nations whose history is being made against a majestic background of mountains, lakes, and plains; of wildlife and still primitive tribes.

November 27

High Horizons

Colorado Wilderness

William Ferguson

High Horizons is the far reaching story of a vital natural resource—water. Told by a naturalist, the film begins with the melting snows above timberline in America's Rocky Mountains, and follows the waters as they drop past the Colorado upland meadows to the fertile prairies below. Ferguson and his wife have long made their summer home at Estes Park, where they are close neighbors to the wildlife of the foothills and snow-capped peaks. In their film, the sweep of wilderness Colorado, its beauty and action, its animals and plants, are vividly portrayed. ■

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CHICAGO NATURAL HISTORY MUSEUM
Bulletin
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Fig. 1. Buffalo hunt

Plains Art from a Florida Prison

by GEORGE I. QUIMBY, Curator of Ethnology, Thomas Burke Memorial Washington State Museum and Professor of Anthropology, University of Washington, formerly Curator of North American Archaeology and Ethnology, Chicago Natural History Museum

The vividly illustrated Indian sketchbook discussed in this article, along with several other examples of Plains Indian art, will be displayed in Stanley Field Hall during October.

A FLORIDA prison became a lively center of Plains Indian art during the years 1875 to 1878 when some 72 Indians captured on the western frontiers were held as prisoners of war in Fort Marion at St. Augustine. Art flourished in this unlikely environment because it was encouraged by their humane jailor, Lieutenant Richard H. Pratt, who had fought against them in the West. About a third of these young warriors of the Cheyenne, Arapaho, and Kiowa tribes made pictures in color using materials supplied by Lieutenant Pratt. Many of the pictures were in bound sketchbooks and the subject matter consisted of recollections of tribal life, their eastward journey by prison train in the spring of 1875, and their life as prisoners of war in Florida. The former warriors took readily to art because recording their manly exploits in color on prepared hides had long been a part of their cultural tradition in the days of their tribal life.

A number of sketchbooks made by the Indians at Fort Marion exist in various collections. A beautiful example, the work of an Indian named Cohoe, has recently been published with a commentary by Dr. E. Adamson Hoebel and Karen Daniels Petersen.[1] In the collections of Chicago Natural History Museum there is a heretofore unknown sketchbook made by the Fort Marion prisoners. It is the work of Howling Wolf and Soaring Eagle, who probably were Cheyenne Indians.

The new sketchbook (catalog number 83999) was given to Chicago Natural History Museum by Mrs. A. W. F. Fuller of London, England and was formerly in the collection of the late Captain A. W. F. Fuller who obtained it in 1930. It measures 8¾ x 11¼ inches and contains eight pictures done in color with crayon, ink, and pencil used in combination. Like others of its kind some of the pictures closely resemble paintings on robes or tipi curtains. Others are uniquely Fort Marion in style and content. The subject matter is divided between recollections of tribal life and their long overland trip by rail from the western Plains to their prison in St. Augustine, Florida. The sketchbook, as a chronological record of events, makes more sense if viewed from the back to the front of the book, and I consider them in this reverse order here.

The first picture (fig. 2 in this article) represents a scene and event prior to the captivity of Howling Wolf and Soaring Eagle. It probably is a ceremony of one of the Indian soldier societies. The rituals are being performed inside a tipi and the women of the tribe are seated outside in the foreground. The men at the right of the tipi are holding umbrellas decorated with eagle feathers.

The cover illustration shows a ceremony probably being performed by one of the soldier societies at a time antedating the outbreaks of 1874. A group of 26 Indians is seated in a circle, probably inside a tipi. At the near end of the circle there are two women wrapped in one blanket.

A spirited buffalo hunt is shown in figure 1. A party of mounted hunters splendidly dressed and armed with bows and arrows is in pursuit of bison. Four of the buffalo have been wounded by arrows.

Figure 3 seems to represent another soldier society ceremony that took place prior to 1874. The locality probably is one of the several forts at which the Cheyenne were given

[1] I would like to express my appreciation to Karen Daniels Petersen for supplying important parts of the information used in preparing this article.

Fig. 2. Indian ceremony

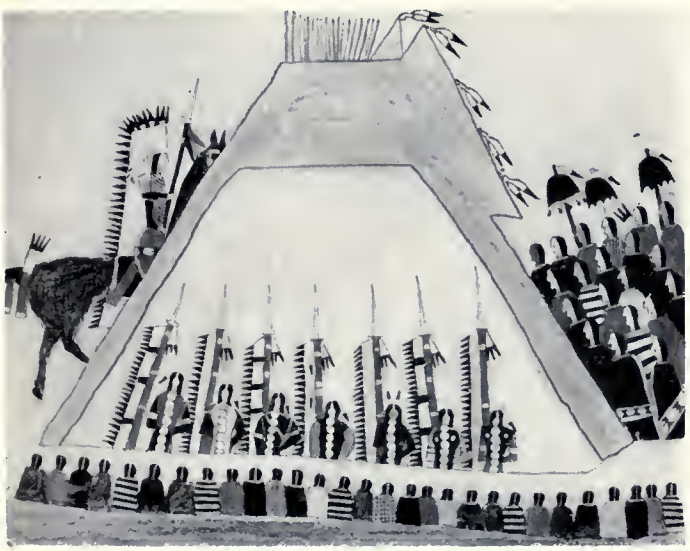
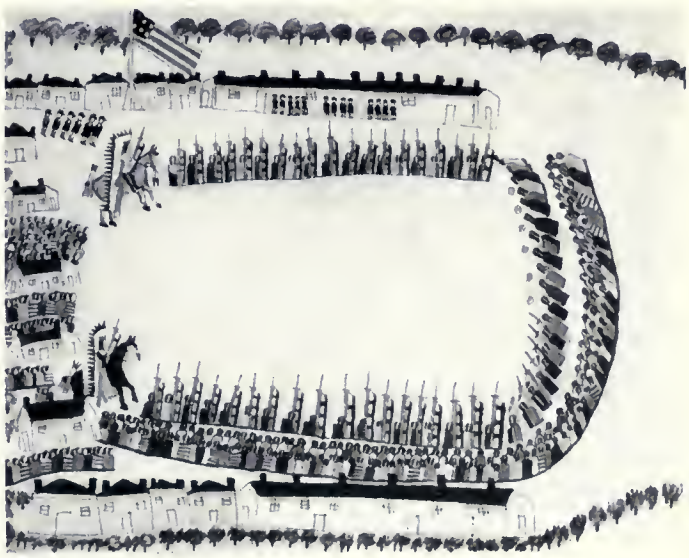


Fig. 3. Ceremony at Army post before uprising



rations before the Darlington Agency was established. The Indian warriors in a U-shaped line probably are intended to be standing. The women are in a double row behind them. The two dance directors, carrying decorated lances and wearing elaborate headdresses trailing eagle plumes, are mounted on horses. In the background are military post buildings, Indian women, and United States soldiers.

Figure 4 also represents a United States military post and some events that took place there, after the outbreak of 1874. The Indians are encamped outside the fort in a grassy area with two ponds and a winding stream. Guarded by U. S. cavalry and foot soldiers with guns and bayonets, two groups of Indian men (twenty in one group, ten in the other) are being listed or registered by an army officer who is writing on a tablet. The man behind him in civilian dress may be an interpreter. Elsewhere in the picture there are other Indians, soldiers, 4 clusters of tipis, military buildings, and an American flag. In the upper left hand portion of the picture there is a group of white men and one white woman in Victorian dress.

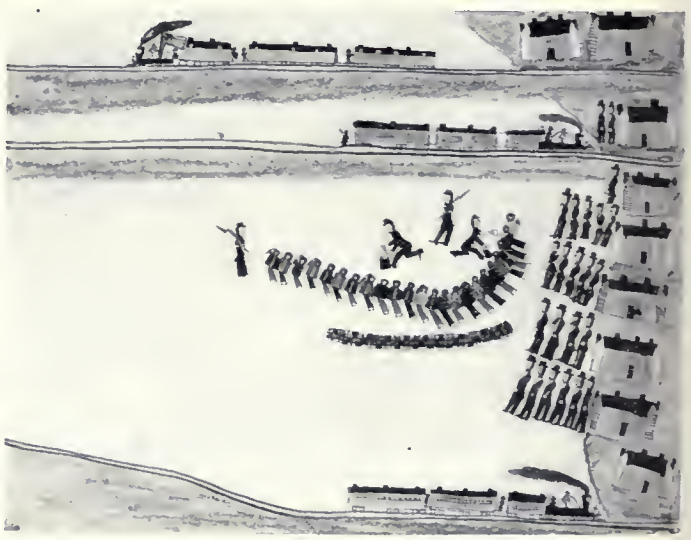
The subject of the next picture (fig. 5) is a journey on a prison train. A steam locomotive and three cars are shown in three different places. Probably the artist intended to indicate the beginning of the trip, a stop at a military post somewhere enroute to Florida, and the departure from the military post. There are guards on the train, but not many soldiers in the rest of the picture. Twenty-three Indians in a line are being given water or food by two soldiers while two other soldiers stand guard with rifles and bayonets. Behind the Indians there are 22 white men possibly intended to represent newspaper reporters or crowds of onlookers, and one soldier, perhaps meant to be Lt. Pratt. The buildings may be those at some station where the train stopped for servicing. The artist has drawn these buildings so that one views the front and both sides simultaneously, a convention used frequently in this sketchbook.

Figure 6 shows a large body of Indians at a military establishment. The Indians are being issued blankets, buckets, axes, and other useful items which are piled in the center of the scene. A sutler's wagon drawn by horse probably has just delivered these supplies which are being distributed by chiefs. Also in the center of the picture there is a chief talking to a bearded white man who stands back to back with an Indian who is speaking to the assemblage. The lines from his mouth signify speech and it rather looks as if he is speaking forcefully. In his left hand he holds a pipe and a fringed pipe bag. In the upper half of the scene two chiefs are displaying blankets and buckets they have taken from the pile. Dashed lines show their tracks. Similarly in the lower half of the picture there are two chiefs whose tracks indicate that they have been at the pile of goods displayed in the center ground. The chief at the left is smoking a pipe. The chief at the right is distributing food from his bucket. Although all of the action is taking place within a military post there is only one soldier in evidence. He stands at the right.

The last picture (Figure 7) shows the arrival of the Indian prisoners at Jacksonville in the spring of 1875. At the right there is the train with steam locomotive that brought the Indians to Florida. It is standing on a pier at the end of its journey. The Indians have now been transferred to a steam-

Fig. 4. Indians under guard at Army post

Fig. 5. Enroute to Florida prison



boat that carries them part of the way to their prison at St. Augustine. In the background is a crowd of white onlookers. The steamboat in the center of the picture also carries soldiers armed with rifles and bayonets. The ocean and boats were a new experience to these Indians of the Plains. Although the artist has done a good job with the small gaff-rigged sloop at the lower left of the scene, the auxiliary schooner in the lower right is sailing backwards or else he has reversed the rigging. In any case, he has successfully portrayed the radical change from the world of the Plains to the world of the sea which must have impressed the Indian prisoners tremendously. It was on the bottom of this picture that Howling Wolf and Soaring Eagle signed their sketchbook.

The Indian prisoners were released from their Florida captivity in April of 1878. A number of the prisoners, Soaring Eagle among them, then entered the Hampton Institute, a Negro agricultural and industrial school in Virginia. There one former Cheyenne warrior became an apprentice tailor among fifty Negro girls. In the summer of 1879 Soaring Eagle was among a group of Indians working on farms in New England. Howling Wolf returned to his western home and for a while at least tried to live like a white man. Only their art remains, evoking the doomed way of life of the Plains Tribes, and their troubled contact with the expanding Republic.

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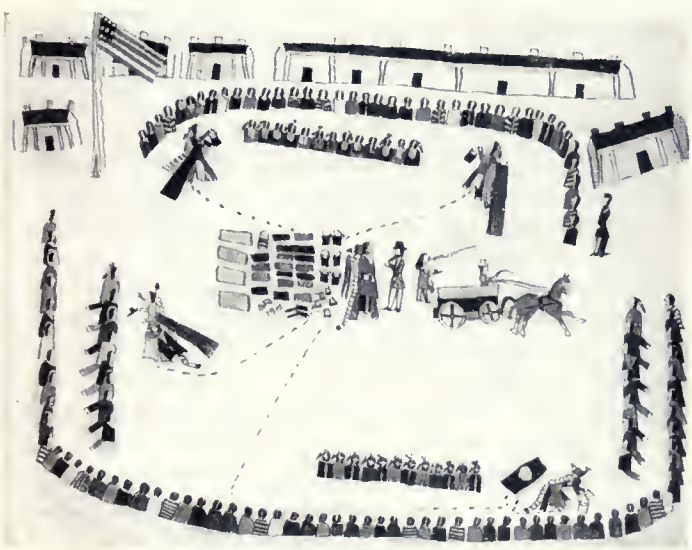
Fig. 7. Nearing journey's end, Fort Marion

Fig. 6. Issuing equipment



Mr. Quimby, for many years Curator of North American Archaeology and Ethnology at Chicago Natural History Museum, recently resigned from the Museum to accept an appointment to the faculty of the University of Washington and to the staff of the Thomas Burke Memorial Washington State Museum. He will remain connected with Chicago Natural History Museum as Research Associate, North American Archaeology and Ethnology, and it is hoped that his name will continue to distinguish the pages of the BULLETIN.

Expedition truck beside camp at Paghman

letter

Kabul, Afghanistan
August 2, 1965

JAN and I landed in Kabul June 23. The further delay of *M.S. Hastings* with our shipment suggested that we leave Tehran direct for Kabul instead of Karachi. A good thing, too! That time was well spent in establishing contacts with government officials and in gradually learning the ropes.

On June 26 I received a cable from Henry Selz of the CARE Mission in Karachi, advising the *Hastings* had arrived. He had the shipment off the boat and cleared in 48 hours. Shanawaz, Ltd. and International Harvester had the cars serviced and ready to go almost simultaneously. I flew to Karachi on the 28th of June, intending to fly back after clearance was completed, but when I found how ready everything was to go, I decided to stay with mammalogists Jerry Hassinger and Hans Neuhauser and make the trip up to Kabul with the shipment. Jan meanwhile, in Kabul, hired a cook and was buying provisions. From one point of view it was a good choice to motor back to Kabul, but from the personal point of view it was an endurance contest. The Pakistan scenery was interesting, but the heat was so unbearable that one nearly lost interest in anything but survival!

Our two cars, trailer and truck left Karachi at 6 p.m. on the 29th, and arrived at Hyderabad about 10 p.m. Shanawaz, Ltd. sent a man along to check the cars that night, which he did from midnight to about 2 a.m. At 5 a.m. we were up and away shortly thereafter. That day I got a taste of what it is like to ride in heat registering about 118°. We finally arrived at Rahim Yar Khan, where arrangements had been made to stay at the Lever Bros. Compound (they manufacture a number of products here) where they take pity on poor travelers like us, bless them. Slept in the home of Mr. Howe, the manager, in, of all things, an air-conditioned room. Restored, we spent the next day with wet bath towels over our heads and dripping water, as often as we could find water to soak in. By-passed Lahore and Rawalpindi with a short cut through the desert and then decided to drive on at night. Arrived at Campbellpore about 3 a.m. Slept on the front seat until 6 a.m. and then to Peshawar, where we arrived Friday, July 2. With everything closing at noon, I took on the chore of clearing Pakistan Customs while the men went to bed in the Dean Hotel. With the help of a sympathetic major in the Pakistan Customs we cleared the shipment ourselves.

The land of historic Khyber Pass belongs to Pakistan but it really is Pushtu country and in some ways considered "No Man's Land." Must have taken us an hour to negotiate it. No photographing is allowed. The Militia there reminded me of pictures of Pancho Villa, men with black mustaches, each with a rifle and one or two bandoleers of cartridges slung over his shoulder. Along the way various British regiments have put their insignias on the cliffs for all to see. On one disastrous retreat only one British soldier reached safety; it's easy to understand why. A handful of defenders could run over the tops of mountains bordering the pass and with plenty of cover pick off the poor invaders struggling to escape below. This particular stretch of country is ruled by local chiefs and naturally attracts many try-

Mr. and Mrs. William S. Street, Field Associates of the Museum, here report on the progress of the Afghanistan Expedition, which left Chicago in mid-June (see BULLETIN, *July, 1965) and is engaged in collecting mammals and their parasites in that country.*

rom

AFGHANISTAN

ing to escape justice and get asylum in it. All along above us we could see the Militia squatting on rocks watching the road below. Seeing it one almost has the feeling it's play acting, but when I proposed to take a picture of one of the men at the entrance gate, he clearly wasn't playing. He gave me a negative answer and was pretty serious about it, too.

Needless to say, I slept that afternoon and night and the next day we made Kabul in the early evening, about 1150 miles all told. All the road through West Pakistan is paved for one car, with shoulders on each side. We played chicken with every car coming in our direction. If he was bigger than we were, we veered first. If he was smaller, he moved first. There were a few nonconformists; so there always was the unexpected. Glad Jan wasn't along. She wouldn't have had a nerve left that wasn't in shreds.

Dr. Lewis, our Medical Entomologist, and Sana Atallah, his graduate student assistant, arrived at Kabul the night of July 4, having driven from the American University at Beirut; so the party was now complete. The shipment was now through Customs, and we were ready to repack and get out of Kabul as soon as possible. In this process Brian Reardon, the local representative of International Harvester, and his wife, Helen, have been of tremendous help. His five years of experience really count.

Our first camp was at Paghman from July 12 to July 23, only about ten miles from Kabul, altitude 8,000 feet. This was an area Jerry wanted to check on because mammal specimens had been previously collected there. We collected over 200 specimens and obtained some nice series of species previously reported but very limited in quantity.

Next we went to Shumbul village in the Shibar Pass area of the Hindu Kush, on the road east to Bamian. Here our camp was at 8,500 feet, and we worked up to 9,800 feet, the height of the pass. As in Paghman, this was a place previously collected and again we added good series of certain mammals where earlier collectors got only very few. To date our collecting is doing very well. With four men out collecting and Jan and I available part time for that, and all of us skinning when necessary, I can see that we are very likely to exceed the numbers of the Iranian trip. We have found that if we have a big result in some 24 hours of trapping and hunting we can put up almost fifty specimens under pressure.

We returned to Kabul with some 350 specimens of mammals and from these Dr. Lewis had obtained about 800 fleas and over a thousand ticks, etc. Before you gulp at these flea figures, remember we have to catch the mammal before we can collect its fleas, and not all individual mammals have fleas. Bob Lewis is delighted with our ecto-parasite collecting. He and Sana are both good mammal collectors themselves so they contribute tremendously to our result. However, from the mammal collecting viewpoint only, getting ecto-parasites frequently means an extra visit to the traps, usually about 10:30 p.m., making bedtime for the collector about midnight and then up at five to pick up the rest of the traps. This is because the parasites tend to leave a body that gets cold. After about four days in a row of this kind of going I try to insist on the men showing up. My guess is

Map showing route of expedition

they are now beginning to realize that a six-months expedition is different from a two or three-week trip. So, as time goes on, we will pace ourselves better.

We are camping high where the nights are cool. The land about us is thoroughly cultivated in every piece possible (and some impossible spots from our point of view). Cultivation is, of course, along the rivers which provide the irrigation in the mountainous areas. Crops are wheat, barley, peas, corn, potatoes, alfalfa, with some patches of other vegetables. We've seen stands of wheat three and a half feet high. All is planted in very small patches of not more than one or two acres. Grain is cut by hand sickle (they are doing it now) and threshed by beating it or running animals over it.

The mountains generally appear bare from a distance but when one is collecting plants as Jan is doing (I'm No. 2 boy in this work) it is surprising to see the variety. I think she has almost 100 specimens already and mostly all different species.

Our camp life is the best. We hate to come to town for we're actually more comfortable in camp. Beds are better, no noise, less likely to come down with something (if we're careful and while we are in the high mountains), good food prepared by Nadir, our cook, and served by Abdul, his helper. After we located Syed Mohammed (he had been recommended to us) and got him up from Kandahar, he turned out to be good at driving and interpreting but was also fat and lazy and not too trustworthy. So he went back after ten days to Kandahar, and we have found a man named Lal Mohammed to drive and interpret. With him we think we're in luck.

Each of us except Dr. Lewis and Sana (who by living in Beirut so long are definitely immunized to some degree) has had one or two bouts with dysentery, accompanied by temperatures between 100 and 102. Most of us have lost weight (I'd guess about ten pounds or more) and are happy for it. Generally speaking, Kabul has been very enervating to Jan and me. During the day we often exhaust our capacity and can do nothing but sit and try to cool off in the evening. High (6,000 ft.) and dry it takes a toll for a while. Until December, January and February we won't encounter too much cold weather unless we're high (10,000 to 15,000 ft.) in the mountains and by winter we'll be heading south to the desert.

For two weeks we have had an Afghan student from the Kabul University Agricultural School, Aminnudin by name. Must have been quite an experience for him but he learned to skin, clean skulls, and go night hunting and trapping with the men.

—William S. Street

PROGRAMS AT THE MUSEUM

The fall lecture series for adults continues on Saturday afternoons during November. The programs are given in the James Simpson Theatre, beginning at 2:30 P.M. Reserved seats are held for Museum Members until 2:25 P.M. Following is the schedule of the November programs. Descriptions of the entire series were published in last month's Bulletin.

November 6	Monsoon Mosaic (India) Telford H. Work
November 13	Scotland and Wales Ed Lark
November 20	A Second Look at Africa Arthur C. Twomey
November 27	High Horizons, Colorado Wilderness William Ferguson

The Illinois Audubon Society's 1965–66 series of free nature film programs begins on October 31 with the showing of *Teton Trails*. Mr. Charles Hotchkiss will narrate the film in person. The program begins at 2:30 P.M. in the James Simpson Theatre.

Cadette Girl Scouts are invited to three programs at the Museum designed to help them earn nature proficiency badges. The projects center on Trees and Wild Plants (October 9), Birds and Mammals (October 16), and Rocks and Minerals (November 7). The programs begin in the James Simpson Theatre at 10:15 A.M. with a movie on the day's subject and then continue into the Museum halls for study of related exhibits. ■

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CHICAGO NATURAL HISTORY MUSEUM

Bulletin

Vol. 36 No. 11
November 1965

Robert F. Inger, Curator, Amphibians and Reptiles

COLD BLOOD WARM CLIMATE

Our general knowledge of natural history is largely based on observations made in the Temperate Zone. That is not surprising since most biologists have lived and worked (and still do) in the Temperate Zone. The tropics have been relatively neglected. To a certain extent, this regional limitation has caused biologists to think in fixed terms that may be misleading. For example, we tend to think that most animals have an annual rhythm.

The yearly cycle of the seasons in the Temperate Zone has profound effects, as we all know, on the activities of animals. Birds migrate north and south on a regular schedule. Frogs call only at certain times, and each species has its own particular breeding season. Insects are dormant in the winter. And so on. Through expermentation and observation we have learned that changes in length of day, increasing temperatures, and in some cases regular changes in rainfall may trigger these various kinds of cyclic behavior in animals.

We can also understand easily why these creatures must behave cyclicly. Frogs are cold-blooded. Their body temperatures drop as temperatures in the environment fall. At near-freezing temperatures, their movements are as slow as molasses in January and at much below 32° they freeze to death. Insects have the same limitations. Birds are warm-blooded and can keep their body temperatures high. But they need food, which becomes very scarce in winter. Any bird species which feeds on insects must move south in the fall or die of starvation.

The parts of the tropics that support rain forest, besides being very warm all year, have heavy rainfall in every month. The cold-blooded animals can remain active at all times. Since plants thrive throughout the year, food, both animal and vegetable, is abundant continuously. One of the triggering signals for Temperate Zone animals—changing day lengths—is weak or even absent near the equator where the difference between the longest and shortest days is only a few minutes. We know that in the continuously humid tropics plant species rarely exhibit regular seasonal or cyclic behavior. But we know very little about the annual behavior patterns of the animals in that environment.

To learn something about the annual patterns of tropical reptiles and amphibians was one of the major goals of the Borneo Zoological Expeditions, 1962–64. Participants in these expeditions were the late Dr. Bernard Greenberg, F. Wayne King, William Hosmer, James P. Bacon, Jr., and myself. The bulk of the field work was carried out by King, Hosmer, and Bacon. The Expedition was supported by National Science Foundation.

The basic field plan called for collecting and preserving twenty to forty individuals of several species of frogs and lizards each month. By recording the date and habitat information for every animal caught, we hoped to be able to detect any changes in abundance and position of these species during the year. The preserved specimens were to be examined in the Museum laboratory; the presence and number of eggs in the females would reveal the pattern of reproductive activity.

We knew from previous experience that snakes would not be caught in sufficient numbers to give us adequate monthly samples. And they were not. The numbers captured each month were sufficient for four species of lizards and six species of frogs. The frogs lived along stream banks and were active only at night, All four lizard species were tree dwellers, but two were active only at night and two only during the day.

Climate in the rain forest is in reality composed of a number of microclimates. The microclimate in the tree crowns is very different from the climate close to the ground. The sun shines through the open branches of the tree crowns, becoming filtered out by successive layers of branches until

Left, native collector gathering data from typical Bornean forest stream; cover, *Phoxophrys nigrilabies*, a rare lizard native to Borneo, in a defensive posture.

near the ground one sees only scattered flecks of sunlight. As a result, the air in the tree crowns is heated each day to a greater extent than is the air near the ground; relative humidity drops more during mid-day up in the tree crowns than below the canopy formed by the branches. An animal, such as one of our arboreal day-time lizards, is active only when the temperature is high. Our nocturnal lizards not only are active in the trees when the temperature is low and humidity high, but they also sleep on the ground under logs during the day and avoid the higher temperatures altogether. Thus the two sets of lizards lived in different microclimates.

None of these species showed any change in position or numbers during the year. Moreover, it is clear that they breed throughout the year. In each monthly sample of lizards, for example, we found some females with eggs ready to be laid. All adult males contained sperm.

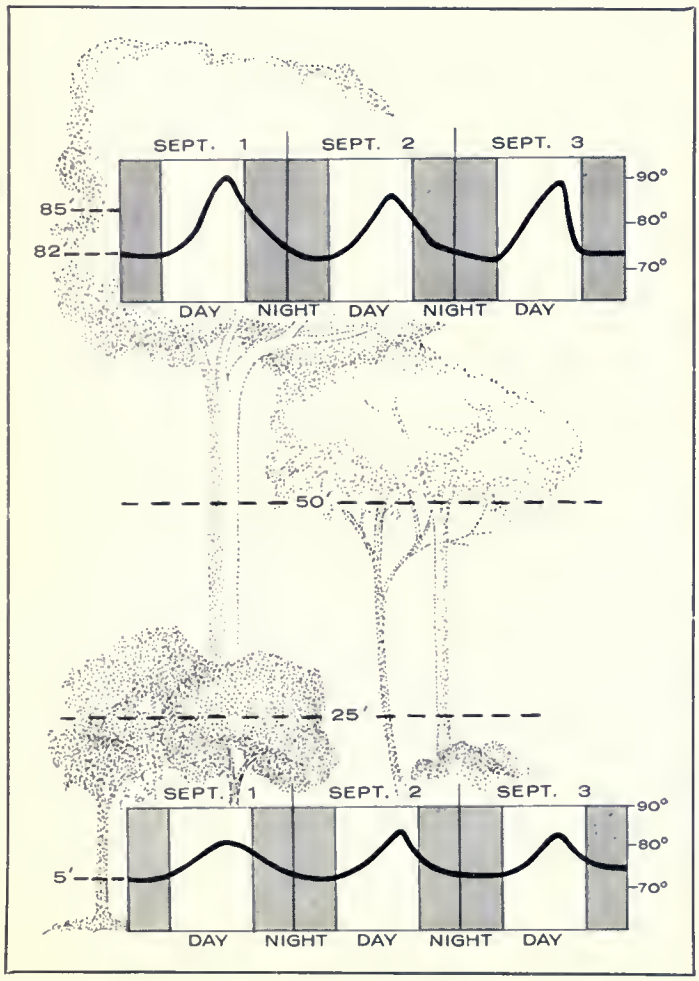
This result is not surprising for, as we have seen, the climate of the rain forest neither imposes the necessity nor provides the triggering signals for cyclic activity. The fact that the nocturnal and diurnal lizards lived in different microclimates had no effect.

One of the other results of our study was not expected. Our collecting yielded adequate samples for estimating the number of eggs per clutch in 9 species of lizards. The largest clutch consisted of 5 eggs, which is rather small for lizards. Much larger clutches (5 to 12 or more eggs) are found in related lizards living elsewhere in the oriental tropics. Those places, though tropical, have distinct dry seasons and the lizards living there breed only during three or four months of the year.

Generally, animals lay enough eggs to maintain their populations at a more or less steady level. Let us imagine two species of lizards that are alike in many ways. Let us say that they have similar population sizes, the same food, the same predators, and the same life span; and let us also stipulate that the females of each can lay a clutch of eggs each month of the breeding season. In order to maintain the same population size, both species will have to produce the same number of eggs during the total breeding season. If the breeding season of Species A is half as long as that of Species B, there is only one way that A can produce as many eggs as B: by having a clutch size twice as large as B's.

Now, going back to our real lizards from the seasonal tropical climate, we can see that they must have larger clutches than rain forest lizards because they have only 3 or 4 months instead of 12 in which to produce the year's quota of offspring.

It frequently happens in biological research that we start out with one goal or question in mind and end by reaching others. In this case the search for an answer to the original question (namely, do these animals show seasonal rhythms) led us to insights into problems of productivity. ■



Left, chart showing "microclimatic" temperature changes at two forest levels; below, *Draco maximus*, one of the flying lizards characteristic of Borneo.

MARSHALL FIELD

1916 - 1965

The death of Marshall Field, in September, cut short a life of public service which added new distinction to an already famous name. Chicago Natural History Museum, of which he had been a Trustee since 1946, shares the sorrow of Chicago at the loss of this remarkable man.

Mr. Field was born in New York City, attended St. Paul's School, and graduated from Harvard University with a Bachelor of Arts degree, magna cum laude, in 1938. He attended the University of Virginia Law School, from which he received his Bachelor of Law degree in 1941, after being elected president of his graduating class.

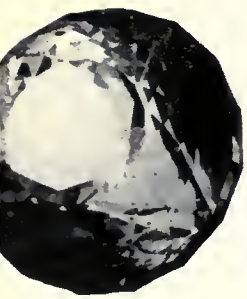
His record as a naval officer in World War II from 1942 to 1945 was a distinguished one. For more than two years he participated in every major naval engagement in the South Pacific, and he was awarded the Silver Star, Presidential Unit Citation, and Purple Heart as recognition for his conduct in the Battle of Santa Cruz.

After the war, he joined the Chicago *Sun Times*, founded by his father. After assumption of many departmental responsibilities from riding circulation trucks to that of assistant publisher, he succeeded his father as editor and publisher on October 1, 1950. He also was Chairman of the Board of Field Enterprises, Inc., a Director of Marshall Field & Company and of the First National Bank of Chicago.

Mr. Field's participation in civic affairs was broad. He was Vice President and Director of The Field Foundation, Inc. and Chairman of the Board and Director of The Field Foundation of Illinois, Inc. In addition to serving as a Trustee of Chicago Natural History Museum, he was a Trustee of the University of Chicago, the Art Institute of Chicago and Presbyterian-St. Luke Hosipital.

He had a great faith in the vigor and vitality of Chicago and hoped to devote much of his life to the building of a greater city. Although the demands on his time were many, he was deeply interested in the Museum and its future and he maintained close touch with its programs.

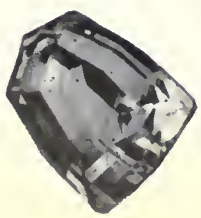
Marshall Field's death at 49, at the period in his life that he hoped would begin his greatest contribution to Chicago, is a loss that only those who knew his intense dedication can know. A man unassuming in demeanor and considerate of all, he desired little other than that he serve his city and country to the best of his ability.



Hall of Gems

One of the world's notable gem collections, consisting of more than one thousand cut and uncut stones of nearly every known variety, is open once more to the public in the Museum's Hall of Gems, after the installation of a modern electronic security system.

Several choice specimens from the Museum's collection of uncut gem crystals have been exquisitely faceted recently by a local lapidarist, Mr. Walter Kean, of Riverside. These latest additions to the Hall of Gems include a 296-carat kunzite of lilac color, a 91-carat topaz, and a 13-carat tourmaline. Photographs of these gems are shown scattered on this page.



From Ceylon and Burma, a selection of blue, yellow, and white sapphires are displayed in the Hall. Six are large "star" sapphires, three of these weighing more than 130 carats each. Also shown are two fine "star" rubies.

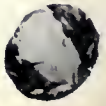
The larger emeralds are displayed in uncut crystals. Emeralds come from crystals of the mineral beryl, and so do the aquamarines, which differ from emeralds only in color. The largest faceted aquamarine in the Hall is an unusually perfect stone, one of the Crane collection, weighing 341 carats. Only slightly smaller is the 331-carat Hope aquamarine.

The collection of faceted topazes in shades of blue, white, pink, and golden, is unusually comprehensive. One of the largest, of rose color, weighs 290 carats. The cut topazes may be compared with a gigantic uncut topaz crystal weighing 90 pounds—one of the largest ever found.

A highly prized specimen is an 11.51-carat alexandrite, a rare variety of chrysoberyl discovered in Russia in 1833 and named after Czar Alexander II. Alexandrites appear green in the daylight, but have the magic-like quality of changing to red under artificial light.

There is also a remarkable collection of historic jewelry in the Hall. The rarest pieces, of lapis lazuli and gold, were uncovered by a Museum expedition to Kish, in ancient Babylonia, and are four or five hundred years older than Abraham.

Other cases hold fine examples of jewelry from India, from ancient Egypt, Greece, and Etruria, and from the Aztec and Inca civilizations.



by Bertram G. Woodland, Curator,
Igneous and Metamorphic Petrology

mountain building

Mallory, the great mountaineer who disappeared more than forty years ago within a few hundred feet of the summit of Everest, is supposed to have said that men climb mountains "because they are there." This famous statement, while it says a great deal about man, says little about mountains. The mountains were not always "there." The very peak on which Mallory lost his life, six miles above sea level, contains rocks which were formed on the ocean floor. This article, and several to follow in coming issues of the BULLETIN, *tells much of what we know about the rise and fall of mountains, about processes which began not long after the birth of our planet and continue today.*

At the present time the earth's land area, comprising about 29% of its surface, has an average height above sea level of 2,700 feet. The agents of erosion, running water, ice and wind, which derive their energy from the sun (an external source) and gravity (an internal source), are forever acting on the land's surface and slowly removing its material to the surrounding oceans. Erosion is, in general, more active the higher the land stands above the sea. Measurements of the rate of denudation (i.e., the load of sediment carried by the rivers) show that the eroding agents would lower the land surface to near sea level in a relatively short time, geologically speaking —say, a few million years, which is very brief in relation to the earth's age, some 4½ billion years. So the question of why there are mountains is a very real one indeed.

The short explanation is that mountains are created by the internal energy of the earth, which acts continuously to renew elevations for further attack by erosion. There is thus a constant struggle between external and internal sources of energy; so far, and apparently for billions of years to come, the internal energy prevails in supplying mountains to be removed by denudation or slumping. Geological studies show that for at least 3½ billion years mountains have been thrust up in one place or another and from time to time. The uplifts are very slow affairs by human standards, although it has been possible to measure the rate of some of the earth's movements. The most obvious manifestations of the earth's internal energy are earthquakes, such as the Alaskan one of March 1964 when an area of some 75,000 square miles was affected by uplift or subsidence (the maximum uplift reported was over 45 feet), and volcanic activity. A further spectacular form of evidence of the effectiveness of uplift in rejuvenating the land is that rocks that must have formed beneath the ocean are now to be found in the highest mountain peaks, e.g., on the peak of Mt. Everest nearly six miles above sea level.

Before attempting to indicate current ideas on the mechanisms and energy sources for mountain building let us first examine some of the characteristics of mountains and the techniques of study applied to the problem of why they are there.

Mountains are not mountains because of high elevation alone but because they stand high above the surrounding land. The higher this differential elevation or relief the more imposing the mountains. Rugged and dramatic mountains may rise 3 to 4,000 feet on the seacoast, while the plains east of the Rockies which are actually higher in elevation are relatively flat and featureless. Thus location of the uplift, as well as amount, influences to some extent the development of relief. More important in this respect is the age of the uplift. Initially, a broad uplifted area may be devoid of relief, but, as rivers form and valleys are cut, relief develops and eventually reaches a maximum. Then it becomes less and less as the residual masses (mountains) far removed from the rivers are gradually worn down. Marked relief can also be formed directly by the uplift process if adjacent blocks are thrust up varying amounts or if uplift of some blocks of the earth's crust is accompanied by subsidence of adjacent ones. In this way *block faulted mountains* are formed, the uplifted masses being separated from the lower blocks by ruptures or faults. Very fine examples of such mountains are the Sierra Nevada range of California and the numerous ranges of Nevada and western Utah where the fault scarps are sometimes exposed by recent movements along the faults. Erosion here does not make the relief but immediately starts to reduce it, following each uplift.

One type of mountain which is not formed by the usual

uplift mechanism is the *volcano*. Here outpourings of molten material from below the crust and carrying with them some of the reserves of the earth's heat accumulate on the surface to great heights and form some of the most majestic mountains in the world, such as Mt. Rainier, Washington, and Fujiyama, Japan. Mauna Loa, Hawaii, is a huge volcanic pile rising over 30,000 feet above the surrounding Pacific floor. Other extinct volcanic mountains in the Pacific have sunk under their own weight beneath the ocean—some to support coral growths as atolls, others to form sea mounts and guyots which have flat tops, formed by wave erosion before they sank.

Dome mountains as the name suggests are more or less circular or oval shaped uplifts, some of which were caused by intrusion of magma (molten rock) into the earth's crust, e.g., the Henry Mountains of Utah, or by intrusion of rock salt squeezed up from depth, of which there are excellent examples in Iran, or by uplift of the whole crust such as in the Black Hills of South Dakota. *Fold mountains* are characteristically formed of parallel ridges and valleys which have resulted from erosion of beds thrown into simple linear wrinkles the arches of which are called *anticlines* and the intervening troughs *synclines*. A classic example is the series of parallel ridges of the Appalachians west of Harrisburg, Pennsylvania. It is to be emphasized that these ridges and valleys are not the simple direct result of the folding but of denudation of such a folded series of rocks.

Other mountain ranges are much more complex than those described above. They are composed not only of intensely folded sedimentary rocks but of large volumes of highly altered rocks, called *metamorphic rocks*, and vast cores of igneous rocks, particularly of a granitic type. Such mountains form the most prominent relief of the continents—the Himalayas, the Alps, the Andes, the White Mountains of New Hampshire, the Blue Ridge of Virginia and North Carolina, the coast ranges of the North American Pacific coast, and many others. Because they form the most prominent relief features of our continents and because the making of these types of mountains has been very important throughout the geological evolution of the earth, at least for the last 3½ billion years, it is with these we will now be particularly concerned.

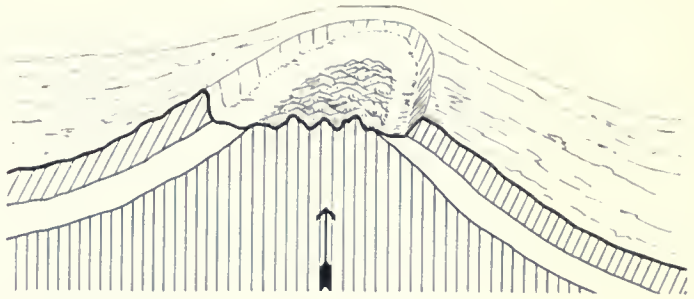
These complex mountains form very long but relatively narrow linear belts which can be traced both by broad physical continuity and approximate contemporaneity of origin for hundreds and even thousands of miles. Within each belt there are, however, a number of zones which differ in details of structure and age of formation. The large thickness of sediments that were originally deposited to form the great masses presently exposed in the ranges demands that the area now uplifted must have experienced a long period of considerable subsidence. This is in contrast to the adjacent continental areas which bear much reduced thicknesses of the sediments of the same age as those in the mountain belt. The latter has thus been a very active region experiencing subsidence of several miles and uplifts of perhaps ten miles or more. The adjacent continental crust areas were relatively stable, moving up or down no more than a few thousand feet. The long subsiding zones which receive great thicknesses of sediment are known as *geosynclines* while the resultant uplifts are called *geanticlines*. Another feature of these belts is the great amount of volcanic and other igneous activity. Much volcanic material is incorporated with the geosynclinal sediments. The nature and composition of the volcanic material alter both in place and time during the development of the mountain belt. Early manifestations of activity in the geosyncline are lavas and igneous rocks of basic and ultrabasic types, some of which when altered now provide us with asbestos deposits in northern Vermont and Quebec. Later the lavas become more acidic and the periodic geanticlines are capped by volcanoes issuing, with explosive violence, a characteristic lava in marked contrast in composition to the quieter effusions of the Hawaiian Islands. Examples of such volcanoes are found today on the Indonesian islands. The mountain-building episode often culminates in the intrusion of truly gigantic amounts of granitic type rocks, such as form the Sierra Nevada mountains. Later in time solutions migrating upward have produced many of the ore deposits from which we obtain our copper, tin, lead, and zinc supplies. But a further important characteristic of these mountain belts is that the

Left: Glacier National Park, Montana, showing ancient flat-lying beds which have been uplifted into a plateau and then deeply eroded to form attractive mountain scenery. Right: Bear Butte, South Dakota, a dome, exposing the core of igneous rock with turned-up sedimentary strata around the base. The previous page shows the Grand Tetons of Wyoming, examples of a block of the crust uplifted between 75 and 50 million years ago; the rocks, however, were reconstructed during an orogeny around 2,600 million years ago.

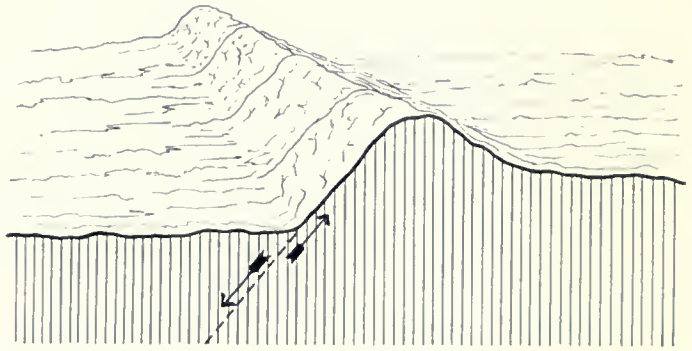
sedimentary rocks have been intensely folded and deformed in a very complex way and large masses of rocks, under the influence of high temperatures and pressure, have been transformed into completely new types. In these metamorphic rocks the deformations have induced new structures, commonly obliterating all of the characteristic features that mark bedded sedimentary rocks. New minerals have grown and chemical compositions may have altered.

The mountain belts which exhibit the results of the forces supplied by the earth's internal energy on such a great scale are known as *orogenic belts*. At the present time certain orogenic belts are high mountainous regions and are of geologically recent origin, as their birth dates from less than 50 million years although their developmental history goes back much longer. Such are the Alps, Himalayas and the mountains of Burma, Sumatra and Java. Other orogenic belts have reached their acme of activity much earlier, e.g., the Appalachians of Pennsylvania some 250 to 300 million years ago and the New Hampshire White Mountains some 370 million years ago. These mountainous regions owe their present elevation to uplifts long after their orogenesis, with its attendant igneous intrusions and metamorphism, had ceased. Even older mountain systems, e.g., the Adirondack region of about one billion years ago, are high ground today. But many orogenic belts are to be recognized in the low-lying parts of all continents, for example, in Canada around Hudson Bay. Such regions have remained remarkably stable for a very long period of time and we call them stable platforms or *shields*. In them the deep roots of the old orogenic systems are exposed to our view to provide evidence of mountain-building dating back to about 3½ billion years. They are exceedingly complex geologically and we have so far only pieced together the merest fragments of their history. We have no record at all of the first billion years of our planet.

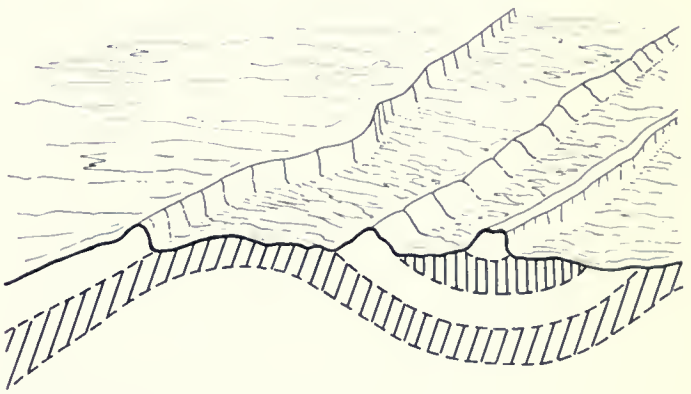
ALL the tools and methods of all the branches of geology as well as of physics and chemistry are applied in the study of such a complex problem as orogenic belts and their origin. Generations of geologists have studied the sedimentary rocks, determined their order of formation and erected a time scale based on fossil content so that the sedimentary rocks can be traced and followed from one exposure to another and from one mountain side to another, enabling the structure of the once horizontal rocks to be worked out and the form of the complex folds and dislocations to be deciphered. In this way, too, we can determine if whole sequences have been completely overturned so that they are now upside down: they often are. Further careful work also provides evidence of the depositional history in a geosyncline—the varying thicknesses of sediment, the recognition of uplifts that interrupted deposition and caused erosion, whether local or widespread, and events of a more catastrophic nature which caused slumping of already deposited sediment into deeper parts of the geosyncline. Detailed studies of the sedimentary rocks themselves and of any fossils they contain tell us much about the environment in which they formed. By tracing their lateral and vertical extents and changes we build up a picture of the geographic distribution and its alteration with time. These



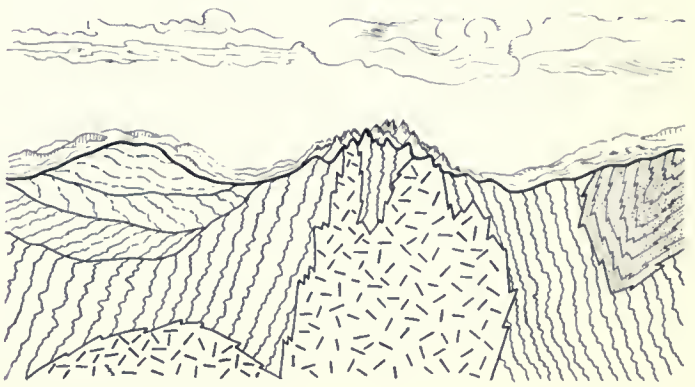
Dome Mountains



Block Fault Mountains



Fold Mountains



Complex Mountains

data give us a dynamic insight into the history of the trough. The igneous rocks demand study to determine their chemical and mineralogic composition, distribution, age and geographic and chemical relationships. From the mass of data so gleaned generalizing principles are attempted which can be dovetailed into all the other data to present an ever more complete understanding of the nature of events and their timing in the orogenic belt.

The metamorphic rocks need special study and techniques of their own, too. We must try to determine the nature of the original rock types. Assuming that they were sedimentary rocks, for example, we face major problems, as their metamorphism and deformation commonly erases most if not all the evidence that would be available to us if they were in their original state. Not only is the depositional history very difficult to piece together, but frequently even the order in which the rock layers were formed is problematical. This makes it difficult to correlate the rocks from one area to another; and so to build up an idea of the structural disposition and form of the rock masses. However, the rocks in their transformation have within them many data relating to the stages of deformation and recrystallization and the operation of the forces which caused these changes. New textures and structures imparted to the rock bear a systematic relation to the overall structure of an area. By careful recording of data, usually obtained by microscopic examination of numerous rock samples throughout an area, it is possible to appreciate relationships and to understand the geometry of the internal structures. Gross structures can thus be interpreted and directions of movement of the rock masses which produced the structures inferred; it is even possible to recognize two or more stages of deformation overprinted in the same rocks. The perfect cleavage of slate, a low grade metamorphic rock, and the micaceous foliation of schist, a higher grade rock type, are structures which are imparted to the rock during metamorphism and have nothing to do with layering as seen in sedimentary rocks. It is such structures, and others, that are studied to develop relationships and interpret the deformation history. Chemical and mineralogic examination of metamorphic rocks enables us to differentiate rock masses into differing environments of alteration. Deep in an orogenic structure, pressure, temperature, and the availability of solutions that catalyze reactions are variables which produce different products from essentially the same initial rock. The occurrence and distribution of these various zones also tell us much of the dynamics of orogenesis and its mechanisms, although again it is often complicated by the overprinting of more than one type of alteration at different times during the total history of the belt. Also, of course, rocks that have been through one cycle or orogenesis may be incorporated into a new orogenic belt and reworked. In the Alps, the geosyncline which later gave rise to the Alpine orogenic belt formed on a basement of an older European mountain system, called the Hercynian orogenic belt (roughly equivalent in age to the Appalachian orogenic belt south of New York State). The Hercynian rocks were then caught up, deformed, altered, and thrust to great elevations in the Alpine orogenesis. In this way portions of a continent are made over, in some areas probably several times, although the evidence of earlier episodes becomes lost if the later reworkings are too numerous or thorough.

The special study of land forms and their mode of origin also has its part in understanding the orogenic process both in principle and in a particular case. Evidence of erosion surfaces sheds much light on oscillations of the land, particularly in the areas that are regarded as sites of active orogenesis today. Such an area is the Indonesian island arc of the Western Pacific. Here many geologists, particularly the Dutch, have collated a remarkable amount of information, often under the difficult conditions of tropical forest, pertaining to the development of geosynclines, geanticlines, volcanism, deformation and intrusive activity which has been traced over a wide area. It has been shown that the history of an orogenic belt is extremely complex and that the zones of subsidence and uplift migrate in time both along the belt and at right angles to it. It might be mentioned here that the data made available by the study of the Indonesian area, which is still an active orogenic belt as witnessed by the numerous volcanoes and earthquakes and observable recent changes in levels are, of course, supplemented by the study of older orogenic belts which have been worn down by denudation to reveal the deeper structures.

Radioactive dating is proving to be a very useful tool particularly in studying the relationship of the old, now much denuded orogenic belts of a billion years of age and older. Here the evidence is so obscured by the complexities revealed that correlations of rocks can hardly be made in the usual ways. Dating of events such as major intrusions and metamorphisms in the various belts, however, is beginning to enable us to decipher the relationships and ages of the various belts in the shield areas.

This article will be continued in subsequent issues of the BULLETIN.

Special Exhibit

ORCHID SHOW

November 20 and 21

Hundreds of orchids—fresh-cut blooms and flowering plants—will be on display at the Museum November 20 and 21 when the Illinois Orchid Society presents its annual show.

To be held in Hall 9, the display will also include an exhibit showing the native origins of many of the species, a series of paintings of orchids, and an educational exhibit by the Department of Botany. The Society's film The Secrets of Sewing and Germinating Orchid Seeds *will be shown during the two-day show.*

CHICAGO NATURAL HISTORY MUSEUM
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Science

Our correspondents are Dr. Fred M. Reinman, Assistant Curator, Oceanic Archaeology and Ethnology, leading the Marianas Islands Archaeological Expedition, on Guam; Mr. and Mrs. William S. Street, Field Associates in Zoology, heading the Afghanistan Expedition, based in Kabul; and Dr. Alan Solem, Curator, Lower Invertebrates, conducting the South Pacific Field Trip, in Western Samoa.

Housing

Cinematic expeditions invariably live in tents; some Museum expeditions do, some don't. From Dr. Reinman, *Housing is practically non-existent. . . .* From Dr. Solem, *the Casino Hotel is standard Somerset Maugham, with 12 foot ceilings, slowly rotating fans, lizards scurrying on the walls and ceilings, three inch roaches on the floors and walls, weather-beaten exterior, undoubtedly termites . . . accommodations are very tight here.* A happier note from Mr. Street, *A perfect camping spot. . . . Each time we say we shall never find a spot like our present camp, but next we seem to get a better one still. The one really bad camp we have had was in the Wakhan Corridor. It was very dusty and had no trees, but there we drank water from the river, good cold snow water, cool and safe.*

Red Tape

Although the authorities are generally extremely cooperative, on occasion mix-ups occur, and sometimes the sad realities of the Cold War touch the scientific expedition. *You'll be pleased to know,* writes Solem, *that I'm accompanied by the only officially approved illegal entrant into Western Samoa of my acquaintance. The entry visa for Mr. Price* (a New Zealand collector, assisting Dr. Solem) *was not provided in time to reach him in New Zealand. . . . Red tape still raises its ugly head. Despite starting in April we still do not have a visa to Tonga for Laurie Price. I am now trying the cousin of the prince who is the favorite nephew of Queen Salote to get a visa for him.* The Street Expedition was lucky enough to get permission to enter the Wakhan Corridor, a thin finger of Afghanistan which runs between the Soviet Union and Pakistan and barely touches on China. A number of other expeditions were refused entry into the area. The Government sent an escort with the Streets: *The Soviet border is no more than 25 or 50 yards away on the Oxus River, and we go alongside it. With us are the Colonel, a Major from Faizabad and three or four soldiers. When Jan* (Mrs. Street) *went plant collecting a soldier went with her. Bob Lewis* (expedition entomologist) *had a soldier with him when he took off to find something in the valley behind us. The Afghans are taking no chances of our accidentally causing a border incident.*

Wild Animals

Lions, tigers and crocodiles are fine on film, but the real animal enemies are somewhat smaller. From Dr. Reinman, *The bees are still at it. I've been tagged six times since the last letter, twice yesterday, and my arm is swollen from wrist to elbow. * * * Samoan houses offer ideal ventilation and perfect feeding for mosquitos. Europeans, i.e., all non-Polynesians, are expected to set an example, so each Wednesday we now gulp eight hetrazan tablets.* The enemy may not only attack the scientist, but even his subject: *at low elevations tiny ants seem to have eradicated the land snails, as in Hawaii and Tahiti. Alas, poor endontodids, I fear you may be gone.* Sometimes, the enemy is even smaller than that: from Mr. Street, *Most everyone has had a touch of dysentery . . . Sulpha really helps to knock it out with the first symptoms. Cholera is still present and our cook has been sufficiently impressed so that our tea water from the ditch is really boiled.*

Transport

Getting there is not always half the fun. A scientist must have courage: *I learned that Samoan drivers equal the Indian cab drivers in Fiji—previously my nominees for the world's worst;* even a touch of daring: *a couple of the sites* (on Guam) *apparently had never been seen by archaeologists. In one of these areas we had to go over a fifty foot face of sheer cliff hand over hand on a 3/8th inch manilla line to get to a rock fall we could climb down. It was the most in-*

and the silver screen

Addicts of late evening television are familiar with the scientific expedition as a cliché of Grade B adventure and horror films. They know that in the search for knowledge, the devoted—and strikingly handsome—scientists must undergo appalling dangers, which they overcome with great fortitude and bad acting.

While all leaders of expeditions for Chicago Natural History Museum are strikingly handsome, or at least presentable, we have long felt that in other respects the cinematic version of the scientific expedition presents a somewhat distorted picture. From the letters and reports of three expeditions presently working in the field for Chicago Natural History Museum, we have compiled a composite picture of the actual difficulties and joys of expedition. We present it in the public interest—and to set the record straight.

accessible place we have entered yet, and even so we found pottery scattered around. . . . Stamina is essential: *About twenty miles west of Aqcha, Afghanistan, the road . . . was really a series of dust-covered holes in which the car would drop a foot on one side, come out of it, and go into another on the other side. . . .* When promised means of transport do not appear, the scientist on expedition must call on his ingenuity and adaptability to save the day: *This morning we took a taxi out to our snail collecting stations, as usual.* When all else fails, desperate steps are taken: *Sunday we had a six mile hike (fortunately downhill), since everything in Samoa stops as completely as a bible-belt town on Sunday, and where on a weekday there was a car a minute, we saw none in two hours. Nice crop of blisters, too.*

Natives

Museum expeditions are luckier with the inhabitants of their areas than their screen counterparts. *The local people—both Guamanians and statesiders working here—have been very helpful. Some of them have done wonders in terms of struggling through the boondocks on hikes for various reasons and really know quite a bit about the island's archaeology.* Locals do not always appreciate the value of scientific research: *Collecting "sisi"* (snails) *for purposes other than eating them is beyond reason to the Samoans . . . they are a very likeable people.* Many officials go out of their way to help expeditions. A commissioner of the village of Dawlatabad, Afghanistan, had dinner waiting for the Streets after they finished a long desert journey: *In a courtyard with the moon flooding the place with light we were seated on cushions on a rug. He hadn't realized that there would be eleven of us, but soon we were all eating kebobbed lamb, eggplant sauce, rice, fried eggbread and melon, topped off by tea. When it comes to hospitality we Westerners cannot hold a candle to the officials in this part of the world.*

Weather

*The rainy season has set in on Guam with all its fury and the last few days have found us looking like Japanese stragglers just coming in to give ourselves up after twenty years in the jungle. Much too wet to take pictures or do more than scrawl shorthand notes on a soggy pad. * * * Generally, Kabul has been enervating for Jan and me. During the day we often exhaust our capacity and can do nothing but sit and try to cool off in the evening. High and dry, it takes a toll for a while. * * * Rains are heavy and frequent in Samoa, mildly annoying when light, incapacitating when torrential since my glasses lack wipers and without glasses I can't see the snails.* Hot and wet or hot and dry, there is not much that can be done about climate. Only the recollection of the weather they have left behind provides comfort: *I think we have gotten as used to the heat and humidity of Guam as our genes will allow and therefore, while you freeze in Chicago, we just go on looking for an occasional breeze. * * * 91° today in Samoa, with the usual saturated humidity. I would feel better if I could read of a blizzard in Chicago, but mail only comes in on Sundays.*

The End

As the long awaited words THE END flash on the screen, our hero has found the lost temple or exotic animal, has vanquished disaster and gained the heart of the young lady (whom we forgot to mention). Our expedition leaders, having already gained the heart of the young lady, are generally married and often take their families into the field. Nor is the finish of a real expedition so conclusive: months of difficult and painstaking research await them at the Museum, as they study and evaluate their finds. But the excitement of success in their field work greatly outweighs the minor inconveniences of life in the field. *Our box score: 2,010 specimens from well over fifty species of Afghan mammals, plus thousands of fleas and other parasites, botanical specimens, reptiles and amphibians. * * * Although cut, battered and bruised and above all SOAKED, we carry on. Gets more exciting every day with each new indication that many sites on Guam remain to be discovered.* Even smaller results are important: *We have doubled the known material of one new endontodid snail—we have found the second specimen.*

THE FLOW OF INFORMATIO

Zoology's newest exhibit

Austin L. Rand, Chief Curator, Zoology

WHAT do I do in the Museum? How do we get specimens? What do we do with them? and why do we have so many? These are the questions answered by the new exhibit of five cases just installed in Hall 13, using birds to illustrate the points. In one form or another, I have been asked these questions many times. They are easier to answer when you are talking to an individual. You can evaluate your listener and modify your pitch until you see you are getting across.

A satisfactory answer must be an intellectually satisfying one. It must fit into the questioner's background of information and his way of thinking. It must correlate with his frame of reference, and by building on what he has, enlarge his horizons. An answer in different terms is needed for a research meteorologist, a college teacher, a business executive, and an intelligent layman.

To answer the research meteorologist is easiest, for he is a man of few words even if they are big ones. I am a museum zoologist, specializing in ornithology and using specimens in my studies.

The college professor is a bit more complicated, for he likes to have things spelled out in a way that he can repeat to his class. For him I am a naturalist, one whose studies center around information to be read from specimens. Zoogeography, speciation, ecology, and behavior are my special interests. In these fields of study I make the results available to students by publishing them in journals and books, and available to the general public through the preparation of exhibits—three-dimensional displays of specimens, art work and text.

To the business executive, I say the Museum is like a factory of knowledge with wholesale and retail outlets. The raw material is specimens from field and forest, and our notes made while collecting this material. These, along with information in books, we process to produce new information, or to reinterpret old information in new ways. This we wholesale in the form of scientific papers and monographs, to be used by the retailers, the teachers and writers who prepare lectures for college courses and books for the public. Some information we prepare for the retail trade ourselves,

in books and articles for the general public. Some we retail by incorporating it into exhibits to place in our own museum exhibition halls, which are seen by an impressive total of 1,500,000 visitors annually.

For the intelligent layman, the best answer I have been able to devise is, "I write books about birds. Other curators in Zoology write about other kinds of animals." The printed page is familiar to most people and this gives a first common meeting ground. From this it is easy to talk about the specimens needed to supply the information; the Museum's role in providing facilities for study; the ways of getting specimens and the facts and ideas to be secured by studying specimens. Finally, one comes to the ultimate role of this information which will affect our understanding of man and nature, an understanding that becomes increasingly important in our complex modern world.

To explain this story to an individual is one thing. To prepare an exhibit to convey the same story to the cross section of the American public represented by our million and a half annual visitors, is another. The exhibit must be colorful, intriguing enough to attract the visitor, and interesting enough to hold him. The story should be told simply enough to reach the completely uninitiated, yet with enough intellectual content and artistic merit to appeal to the sophisticated. There must be enough diversity in material and approach so that there is something for everyone.

Exhibit panel showing scientist at work in the field

With these as our guidelines, we have prepared the story in five unit cases. We have given it the running title of THE FLOW OF INFORMATION to indicate that the information comes from animals in the wild that are brought as specimens to the Museum, where they are interpreted, and the information finally gets to the public by way of various books, or through exhibits.

The first of the five cases simply points out that Zoology is the study of animals, and that the Museum has specialists in mammals, birds, reptiles and amphibians, fishes, insects, and mollusks, each group illustrated with specimens. Though each type of animal needs different specialized techniques, the basic goal of the specialist in each is the same: to understand living nature.

The second unit case, labeled EXPEDITION and using birds as examples, shows specimen-collecting. A curator sits at a table in camp, surrounded by his equipment, preparing specimens and writing notes. Finished, dried specimens partly fill an open trunk. Real objects, replicas, photographs, silhouette cutout figures, and art work tell the story one way, while the story is also outlined in another, in two outsized pages of "comic book" type cartoons.

The third unit, labeled RESEARCH, shows the curator in his study, bent over his work table, with his material and reference works spread out in front of him, near a case of specimens. Actual specimens are arranged to the left to show some of the puzzling problems that have been solved by museum researchers. On the stand below is a handwritten manuscript and a typescript that have been used in a book.

The fourth case, EXHIBITION, shows how exhibits are made, from the original planning, layouts, pilot models, through art work, modeling and casting, taxidermy and reproducing of plant material, to the finished specimens and paintings. This provides a glimpse behind the scenes of the sort of work that goes into the exhibits of animals in Zoology exhibition halls. There one can see a synopsis of the various groups of animals in systematic series, and also these animals in habitat groups from various continents, giving windows on the world.

Finally, the fifth case, COMMUNICATIONS, shows the all-important flow of information from book to book to people. The dull looking scientific reports on the left are read by only a few people. But they provide the scientific basis for the more popular books with gaily-colored jackets in the center of the case, books read by the many. Ultimately, some of this information is gathered and woven into theories published in readable, philosophical books such as those shown to the right. From these theories come ideas that influence man's thinking, his social activities, and his concept of himself and the world around him. Lastly, the newspapers publish items about nature in its many aspects, giving the reading public an additional opportunity to be biologically literate.

CHICAGO NATURAL HISTORY MUSEUM

MUSEUM NEWS

This month's cover: a bronze plaque of a King of Benin, assisted by two courtiers. From Chicago Natural History Museum's extensive collection of objects from Benin, Nigeria.

WINTER JOURNEYS FOR CHILDREN

Two self-guided tours, especially designed for the holiday season, await yuletide visitors to the Museum. One directs visitors to exhibits of plants and animals of Biblical times, and the other introduces children to the new winter Journey, "Winter Greens."

The new Journey takes a close look at some of the most familiar plants of the holiday season—red-berried holly, firs, waxy mistletoe—and uncovers some fascinating and little-known facts about the greens. Youngsters and their families taking the self-guided tour will learn, for example, how an animal "plants" mistletoe; will learn of some unusual by-products of the Christmas tree, and discover that it is only the female holly plant that produces red berries.

Available from December through February, the new Journey on "Winter Greens" will also acquaint visitors with some of the legends and lore that surround these holiday plants.

Boys and girls who wish to answer the questionnaire accompanying the Journey will receive credit in the Museum's Journey Program.

The annual self-guided tour of "Bible Plants and Animals," available from mid-December through mid-January, takes visitors to exhibits linked with the Scriptures.

The plague locusts that caused famine many times in the Bible lands; the young lions described so vividly in the psalms; and the camel, are a few of the animal exhibits to be seen.

Some of the plants featured on the tour have now all but disappeared from Biblical countries. Among these are the cedars of Lebanon, the magnificent evergreens which furnished wood for the Temple of Solomon. Other exhibits show the olive tree, date palm, fig, and grape.

Direction sheets for both self-guided tours are available at the Museum entrance doors.

PLAN WATER RESOURCES CONFERENCE

The urgent problems of water resources and use will be examined in a day long conference entitled "Water Planning, State of Illinois and Chicago Metropolitan Area" to be held at Chicago Natural History Museum on January 12. The program, sponsored by the League of Women Voters of Illinois, is divided into a morning session on National and State Water Planning, and an afternoon session on Chicago Metropolitan Area Water Planning. Speakers at the morning session will include Mrs. Arthur E. Whittemore, League of Women Voters, on "League Accomplishments on the National Water Scene"; William C. Ackermann, Chief of Illinois State Water Survey, on "Water Resources Planning in Illinois"; Gene H. Graves, Director, Department of Business and Economic Development, State of Illinois, on "Economic Advantages of Good Water Management."

"Water Resources Management in the Chicago Metropolitan Area" by Dr. Gilbert White, Professor of Geography, University of Chicago, and "Guidelines to Intergovernmental Cooperation in Metropolitan Water Management" by Matthew Rockwell, Executive Director, Northeastern Illinois Planning Commission, will be the topics of the afternoon session.

Admission to the conference is free but reservations are required and may be obtained by writing League of Women Voters, 67 E. Madison Street, Chicago, Illinois, 60603.

MUSEUM HOSTS CONCERT SERIES

The American Woodwind Quartet, whose members include three former Chicago Symphony players, inaugurated a new series of Indiana University faculty and student concerts at the Museum November 30.

The Beaux Arts Trio will present the next program in the series January 11. Composed of Menahem Pressler, piano; Daniel Guilet, violin; and Bernard Greenhouse, cello, the trio has been called by *The Washington Post* ". . . one of the world's superlative ensembles."

Subsequent programs will feature the Indiana University Chamber Singers, March 8, and the Indiana University Opera Theater, April 19.

All programs begin at 8:15 P.M.

The Museum will send free tickets for the concerts to those requesting them in writing before each performance. A self-addressed, stamped envelope should be included with the ticket request.

Dr. Kusch

HOLIDAY SCIENCE LECTURES FEATURE NOBEL PRIZE WINNER

DR. POLYKARP KUSCH, Nobel Prize Winner and atomic physicist from Columbia University, will be speaker at the 1965 Holiday Science Lectures to be held at the Museum December 28 and 29. In the audience will be approximately 800 outstanding science students from Chicago area high schools who were selected for the two-day series by their school principals and science teachers.

Dr. Kusch will present four illustrated lectures dealing with the developing knowledge of the electron, one of the fundamental particles of the universe. Title of the lecture series is "The Magnetic Dipole Moment of the Electron." It was for his work in this area that Dr. Kusch was awarded the 1955 Nobel Prize in Physics.

Dr. Kusch will also discuss the general environment in which physics has been done in the past thirty years, tracing and commenting upon some of the very startling changes that have occurred. A question and answer period will follow each session.

The Museum is especially pleased that Dr. Kusch will deliver the Holiday Science Lectures, since he is noted for his teaching ability as well as for his scientific research. Considered to be one of Columbia University's most stimulating teachers, Dr. Kusch received the "Great Teacher Award" from Columbia's Society of Older Graduates in 1959.

The Holiday Science Lectures, now in their fourth year at the Museum, are sponsored by the American Association for the Advancement of Science in cooperation with scientific institutions in major cities across the country. The entire Holiday Science Lecture program is made possible by a grant from the National Science Foundation. The purpose of the program is to bring high school students a first-hand report of work being done by the nation's foremost scientists.

In previous years, the students have heard Dr. René Jules Dubos, microbiologist and pioneer discoverer of antibiotics, who is Professor at the Rockefeller Institute in New York; Dr. William A. Fowler, nuclear physicist from California Institute of Technology; and Dr. Francis O. Schmitt, molecular biologist at the Massachusetts Institute of Technology.

VERTEBRATE ANATOMIST JOINS STAFF

THE Curatorship of Vertebrate Anatomy, vacant since the death of Dr. D. Dwight Davis early this year, has been filled by the appointment of Dr. Karel F. Liem as Assistant Curator of Vertebrate Anatomy. Dr. Liem is Assistant Professor of Anatomy in the College of Medicine, University of Illinois in Chicago, and will continue in his faculty post. The dual appointment, which highlights the increasing collaboration between Chicago Natural History Museum and the metropolitan Universities, will allow Dr. Liem to maintain a program of teaching at the University of Illinois and conduct research programs at both institutions.

Dr. Liem was born in Java, Indonesia, and gained the degree of Master of Science from the University of Indonesia in 1958. He received his doctorate in Zoology from the University of Illinois, Urbana, in 1961 and then became Assistant Professor of Zoology at the University of Leiden, The Netherlands, where he served as Acting Head of the Department in 1963. He joined the Faculty of the University of Illinois in 1964.

His research is concerned with the analysis of feeding and respiratory functions in the air-breathing and sometimes terrestrial fishes, including the lungfishes, the climbing perch, and the mud skipper. These fishes, which seem to be evolving in the direction of land life, may provide a valuable parallel to the great vertebrate leap from water to land, from fish to amphibian.

Dr. Liem is also interested in sex differentiation in fishes. An Asian air-breathing fish, *Monopterus albus*, is invariably born a female, according to experiments by Dr. Liem, and changes to a male at two and a half years. One Florida fish is a true hermaphrodite, with the ability to fertilize its own eggs. The genetic and evolutionary problems raised by these fishes are being studied by the new Assistant Curator.

MAMMALOGIST REVISES MONKEY GENUS

DR. JACK FOODEN, Associate in Mammals, Department of Zoology, returned recently from a four-month study trip in seven European countries. He measured and recorded observations upon more than two thousand specimens of macaque monkeys in 15 European museums. His trip completes the primary, or data-gathering stage of an intensive taxonomic revision of the genus *Macaca*, a genus which includes the principal species of monkey used experimentally in medical and biological research. This is the rhesus monkey, *Macaca mulatta*, which lives in India, Pakistan, Burma, Thailand, North Vietnam, and China.

The genus *Macaca* contains about a dozen species according to the most recent authorities, and all but one of the dozen are Oriental. These eastern species range from Kashmir 2,000 miles south to Ceylon, from West Pakistan 3,500 miles eastward to Northern Honshu, Japan, and 4,500 miles southeastward from West Pakistan to Timor, Celebes and the Philippines. Their greatest north-south range is from Honshu to Timor, which is 50° of latitude. The one western species, *Macaca sylvana*, lives in Morocco and Algeria, nearly 4,000 miles from its nearest relative, *M. mulatta*, and extends the geographic range, albeit discontinuously, to more than 9,000 miles, from Timor to Morocco. The range of the genus *Macaca* thus greatly exceeds that of any other living genus of primate except man.

The number of species of *Macaca*, the wide geographic range and the truly immense amount of knowledge that many kinds of research have yielded on the one species, *mulatta*, would in themselves make this taxonomic revision of the genus *Macaca* one of much importance. Other factors, however, endow this study with a sense of urgency. One factor is the growing knowledge of the importance of the macaque monkeys as reservoirs of diseases affecting mankind and transmitted from monkey to man by biting insects in the substantial part of the earth that the macaques coinhabit with man. Another factor is the explosive expansion of medical, behavioral, anatomical, and other federally-supported research on live macaques of several species. For this research to have significance, a medical scientist in field or laboratory needs to know infallibly the species of macaque his research involves. In the state of knowledge of *Macaca* existing today, this is not possible. Dr. Fooden's study of the great suites of specimens available in the larger museums of the world today intends to close these knowledge gaps with a completeness never possible before.

This research is supported by a Public Health Service grant from the National Institutes of Health to Chicago Natural History Museum where Dr. Fooden does his research on afternoons and weekends. Dr. Fooden is an Assistant Professor at Illinois Teachers College—Chicago (South).

Lion-tailed Macaque, the Indian species *Macaca silenus*

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